Data for paper publishw
1932 (Oct)
Carnegie Inst. Wash Pub 429

① Check what collection is from a tarsus of Puffinus priscus, In Cedies paper I refer to tarsus of P. priscus is known.

② Check Parapavo mt. beak is it # K2475 ✓ mt. K2474

furcula, is it #6535 ✓ mt yes

③ Ciconia material Mck.

4 ~~Eagle bon~~ Terry nos. old or new cat.

M. woodwardi R femur C1111 in mt; coracoid (L) D4676 in mt.
" " scap. D4816 in mt., furcula 3056 in mt., prox radius C4224 mt
" beak C6846 mt., ? mandible (only one avail D1019 —
not listed one way or the other with mt but was in 1st list 5/9/35

G. fragilis Tibia C7332 mt; coracoid (R) E4079 (mt;
" " furcula C8184 mt. (only complete one); pelvis 6481 mt. only one complete;
" sternum 7927 (mt); cranium D1184 & rostrum 1142
(belong together and in mt.)

G. grinnelli - tarsus C6804 mt, tibia 3103 mt; femur C1028 mt.
frag. coracoid, carpo. is NOT in MT
pelvis C1036 mt; sternum C5981 mt.; furcula D2508 MT;
scapula C4450 MT.; mandible C5652 MT.;
rostrum F3071 MT.; ulna C1939 Mt; [radius not listed for mt.]

Neogyps errans coracoid C5467 MT; dist radius C1528 MT;
[cranium C2053 ? mt) crossed out
furcula D6522 mt; radius D7841 mt; pelvis E2051

Outline of
Eagle paper
submitted to Dr. Merriam
thru Dr. Stock
Granted $150 from Carnegie
for illustrations.

THE EAGLES OF RANCHO LA BREA

I The eagles of Rancho La Brea include the following species:

*Geranoaetus fragilis

*Geranoaetus grinnelli

*Morphnus woodwardi

*Wetmoregyps daggetti

Aquila chrysaetos

Haliaeetus leucocephalus

To these are added two other species of Falconiform birds from Rancho La Brea:

*Neogyps errans -- between the eagles and the old world vultures in relationship

*Neophrontops americanus -- of the family Vulturidae.

Those species which are starred are extinct.

II The purpose of the paper is to give a detailed description of these extinct species, which, with the exception of Wetmoregyps and Neophrontops, have been, to date, described only from the tarso-metatarsus. In Wetmoregyps the tibio-tarsus has also been described, and in Neophrontops the tibio-tarsus and humerus.

III The proposed plan of procedure involves,

For each species

A detailed description of each of the principal elements of the skeleton.
(I should like to develop this section of the paper by a presentation of accurate, detailed drawings, or retouched photographs of each element of each species, as well as simple line drawings to indicate exact position of measurements given. In the species, Neogyps errans, the study of which is nearing completion, there are fifteen bones to be photographed, involving 30 detailed, and 8 line drawings; the other species will probably average the same).

A survey of the skeleton as a whole with discussion regarding relative size of wings and legs; and conclusions to be drawn regarding habits and relationships of the species.

III continued

For the group as a whole,

A discussion of the environmental niches occupied by the species under consideration.

A comparison with the modern raptorial avifauna
- Of North America
- Of South America
- Of the Old World

IV The relation of the proposed paper to Dr. Loye Miller's work on Rancho La Brea birds:

Dr. Miller described the various species of Rancho La Brea birds, using the tarso-metatarsus, in most cases, as a type. He reviewed this entire avifauna in Carnegie Institution Publication no. 349, and at this time described the skeleton of Teratornis merriami in detail.

Since the discovery of the McKittrick and Carpinteria asphalt deposits, Dr. Miller's studies have been largely confined to these localities, and the continuation of the detailed study of birds from Rancho La Brea has been in large measure turned over to those of us whom he has trained. It was at his suggestion that I undertook the review of Parapavo californicus, published by the University of California, and with its completion, began the study of the eagles. It is hoped that in time all of the avian groups from the La Brea deposits may be similarly reviewed, with particular emphasis upon descriptions of the entire skeleton of extinct forms, wherever possible.

A ~~To be inserted on page~~

Modernskeletons available
for comparison

The following modern skeletons are available for comparison:
(Order ~~h~~as in Brehm)
Family Vulturidae

✓ ☆ Otogyps calvus -- Pondicherry Vulture, one complete skeleton Collection of L.H. Miller no. 226.

✓ ☆ Neophron ginginianus -- Ind. white vulture, one complete skeleton; Collection of L.H. Miller no. 227.

✓ ☆ Species ? -- One skeleton from Ward's, ~~xxxxxxxxxxx~~ incorrectly labelled Haliaeëtus leucocephalus, is undoubtedly a vulturid, the genus and species, of course are unknown, ~~but the probabilities are (by elimination of known genera) that it is either Vultur or Gyps.~~ Collection of Los Angeles Museum no. 232.

☆ Gypaëtus barbatus -- Lammergeier, one complete skeleton; Collection of L.H. Miller, no. 263.

Family Accipitridae

✓ Haliaeëtus leucocephalus -- Bald Eagle, ~~Two in~~ ~~one complete~~ Three incomplete Skeletons; Collection of Los Angeles Museum nos. 32 and 291; Collection of L.H. Miller no. 626.

✓ ☆ Aquila chrysaëtos -- Golden Eagle, four complete; Collection of L.H. Miller nos. 679, 923, 926, 927; f~~our~~ive incomplete — Collection of Los Angeles Museum nos. 3, 4, 5 and Collection of L.H. Miller nos 421 and 471.

see page 2

✓ ☆ Geranoaëtus melanoleucus -- Aguja, one complete skeleton. Collection of L.H. Miller, no. 233.

Fossil material available

As previously stated, all of the main elements of the skeleton of Neogyps errans are available for the present study. The number of specimens of each element will be given in the following descriptions of the separate elements.

✓ ☆ Geranoaetus melanoleucus no. 18471 U.S. National Mus. complete — coll. by str. Albatross

✓ ☆ Heterospizias m. meridionalis ♀ no 227378 U.S. Nat. Mus. Puerto Pinasco, Paraguay. Sept, 8, 1920 Complete coll. by Wetmore.

Modern specimens ~~used in~~ available for comparison
continued

✓ * **Urubitinga anthracina subtilis** Salvador
One complete skeleton; collection of Donald R. Dickey no. 16950

✓ * **Spizaetus ornatus** Salvador?
Two partial skeletons; collection of Donald R. Dickey nos. 16872 and 16929

✓ * **Geranoaetus melanoleucus**
Two complete skeletons; collection of L.H. Miller no. 233 and collection of ~~MxSxNatixxxxl~~ ~~Smithsonian Institution~~ U.S. Nat. Mus. no. 18471

✓ * **Heterospizias meridionalis** Paraguay
One complete skeleton; collection of ~~Smithsonian Institution~~ U.S. Nat. Mus. no. 227378

✓ **Thrasaetos harpyia**
One complete skeleton; collection of Amer. Mus. Nat. Hist. no. 1383. One cast of tarsometatarsus; collection of L. H. Miller.

✓ * **Aquila chrysaetos**
Four complete skeletons; collection of L. H. Miller nos. 679, 923, 926, 927; Seven incomplete skeletons; collection of L. H. Miller nos. 421 and 471, collection of Los Angeles Mus. nos. 3, 4, 5, collection of Calif. Mus. Vert. Zool. nos. 41410 and 42686.

✓ * Urubitinga urubitinga ridgwayi Gurney – one complete skeleton; collection of Donald R. Dickey no. 17185.

✓ * Urubitinga anthracina anthracina – one complete skeleton; collection of Donald R. Dickey no. 15618

✓ Busarellus nigricollis nigricollis (Lath) Salvador
one complete skeleton; collection of Donald R. Dickey no. 17091

✓ Asturina plagiata micrus Miller & Gris. Salvador
one complete skeleton; collection of Donald R. Dickey no. 17128

✓ * Harpyhaliaëtus coronatus furcula sternum, coracoids, scapulae; coll. of Amer. Mus. of Nat. Hist. no. 215 ♂

✓ Rupornis nattereri 6 as above. Am. Mus Nat. Hist 159, 160, 161, 162, 163, 175

Specimens of modern species available for comparison

✓ Urubitinga urubitinga -- Black Hawk, one complete skeleton; Collection of L. H. Miller no. 738

✓ Buteo sp.? -- one complete skeleton; Collection of Los Angeles Museum no. Bi 307.

✓ Buteo borealis -- Red-tailed Hawk, one complete skeleton; Collection of Los Angeles Museum no. Bi 332. eight incomplete skeletons; Collection of L. H. Miller nos. 139, 222, 427, 446, 148, 468, 152, 240

~~Archibut~~

✓ Archibuteo ferrugineus - Ferruginous Rough-leg, one complete skeleton; Collection of L. H. Miller no. 14 One incomplete skeleton, collection of Los Angeles Museum no. Bi 324.

✓ Parabuteo unicinctus harrisi -- Harris Hawk, one complete, one incomplete skeleton; Collection of Los Angeles Museum nos. 2~~4~~5 and 100.

~~Geranoaëtus melanoleucus -- Aguja -- see other reference~~

✓ Morphnus ---- -- Cast of tarso-metatarsus, Coll. of L. H. Miller

~~Thrasaëtus~~

Certain phalange resembling the buteonine are found in three different sizes, ~~the~~ smallest size being the most abundant, the larger size next, and the medium size rep'd by a single spec of each phal. It is thot that possibly the ~~medium size bones~~ ~~belong with Wetmoregyps~~

small bones belong
with U. pag., the large
with morphnus? the
med. with Wetmoregyps

Characters of importance in dignosing eagles

Elements valuable as indicating subfamily relationship

Tarsometatarsus
Tibiotarsus
Femur
Pelvis
Sternum

Furcula
Coracoid
Ulna ?
Radius ?

For generic relationship

Pelvis
Rostrum ?

Tarsometatarsus
Humerus ? (unreliable)
(curving shaft ?)

For specific relationship

Scapula
Humerus
Carpometacarpus

Skull
Mandibles

May 4, 1929

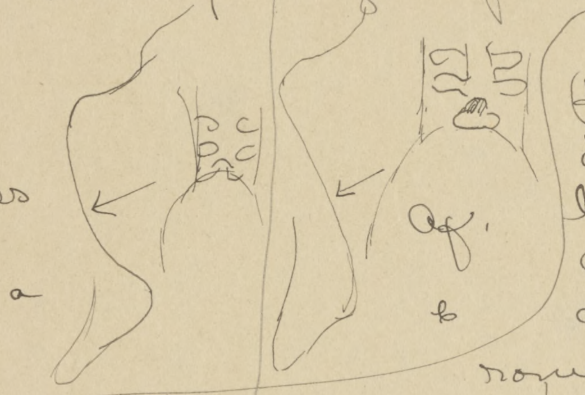
Pelvis

Dorsal view

Postr

Characters found to be constant to a species in specimens (modern) at hand: (4 Buteo, 1 Parabuteo, 1 Urubitinga, 1 Geranoaetus, ~~2~~ 2 Archibuteo, 3 Aquila): Shape of margins of posterior part of ilium — (fig. 1) all hawks + Geranoaetus as contrasted with Aquila have a rounding margin from acetabulum posteriorly; Aquila straight or concave.

Fig 1



(Fig. 2) Buteo, Archibuteo, Ger. + Ag. Parabuteo and differ from Urubitinga in being ~~deeply~~ notched above (and slightly anteriorly to) the antitrochanter + flaring outward post. thereto; Parabuteo evenly rounded, Urubitinga faintly notched

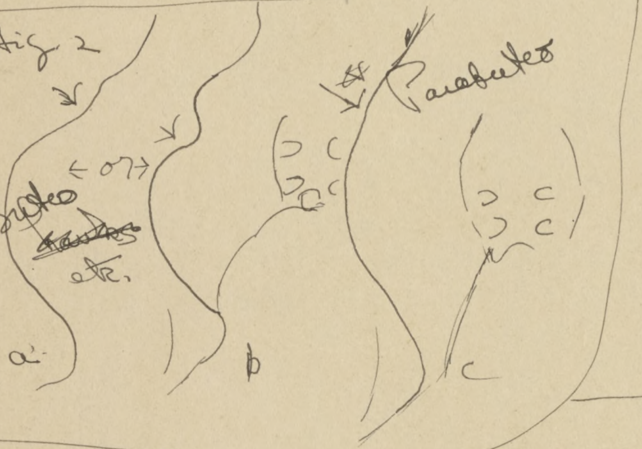
1) G. fragilis ~~between Buteo~~ like a

+ G. grinnelli like b

2) G. fragilis ~~between~~ Buteo + or Geran. Urubitinga.

G. grinnelli like ~~Urubitinga~~ (a)

Fig 2



Ventral view: ~~Buteo~~ ① ant portion; extension of ilium laterally beyond parapophyses in Buteo; widening parapophyses seem to blend right into ilium in Urubitinga; Geranoaetus same as Buteo. ② Parapophyses (especially #3) lacy in Buteo + Urubitinga — not so in Geranoaetus. Aquila somewhat like Urubitinga in ① but parapophyses relatively ~~shorter~~; in ② lacier than Geranoaetus, but as much so as Buteo.

1 G. fragilis — Urubitinga (tendency to Buteo)

1+2 G. fragilis — " + Buteo

over

① G. grinnelli — nearer Urubitinga & Aquila than Buteo & Geranoaetus but edges rounded so no definite margin between ventral & dorsal.

② Near Aquila tho not the same

The Eagles of Rancho La Brea

The diurnal raptores of Rancho La Brea have been described in various papers by Loye H. Miller. By way of summarization the following list is presented:

Cathartidae
- Gymnogyps californianus (Shaw)
- Sarcorhamphus clarki Miller
  - Univ. Calif. Publ. Bull. Dept. Geol. 6, 11, 1910.
- Cathartornis gracilis Miller
  - Ibid, p. 14
- Cathartes aura (Linnaeus)
- Coragyps occidentalis (Miller)
  - Univ. Calif. Publ., Bull. Dept. Geol. 5, 306, 1909.

Teratornithidae
- Teratornis merriami Miller
  - Univ. Calif. Publ. Bull. Dept. Geol. 5, 307, 1909.

Accipitridae
- Elanus leucurus (Vieillot)
- Accipiter velox (Wilson)
- Accipiter cooperii (Bonaparte)?
- Buteo borealis (Gmelin)
- Buteo swainsoni Bonaparte
- Buteo sp. (1)
- Aquila chrysaëtos
- Geranoaëtus grinnelli Miller
  - Univ. Calif. Publ. Bull. Dept. Geol. 6, 314, 1911
- Geranoaetus fragilis Miller
  - Ibid, p. 315.
- Haliaeëtus leucocephalus
- Morphnus woodwardi Miller
  - Univ. Calif. Publ. Bull. Dept. Geol. 6, 312, 1911
- Wetmoregyps daggetti (Miller
  - Condor, 17, 179-181, 1915

Vulturidae

Neogyps errans Miller
Univ. Calif. Publ. Bull. Dept. Geol., 9, 108, 1916
Neophrontops americanus
Ibid, p. 105.

Falconidae

Falco mexicanus Schlegel
Falco columbarius Linnaeus
Falco sparverius Linnaeus
Falco sp.
Polyborus cheriway (Jacquin)

The present paper is concerned only with the the eagles (beginning with Geranoaetus fragilis) and the Vulturidae, which bear a close relationship to the eagles.* ~~This is so close~~ relationship is considered by ~~that~~ some authors to be so close as to warrant placing them all in one family (Knowlton, Birds of the World). Since the species to be considered have heretofore been described only from ~~a~~ one ~~or~~ two or three elements the purpose of the present study has been to describe for each species, ~~separately for each~~ the principle elements ~~of each species~~ separately and as ~~a~~ making up an entire skeleton.

Method of identifying fossil material

In general the identification of the different elements ~~material~~ was based upon (1) Relative abundance as compared with the tarso-metatarsi which in all cases had been used as the type; (2) degree of resemblance to modern forms used for comparison; (3) Size — of value only in separating the ~~[illegible]~~ largest ~~[illegible]~~ associate species from the smallest. ~~[illegible]~~ Details of identification will be given in the discussion of each group.

~~Ma~~ ~~Material available~~

Notes on Eagle tarsometatarsi

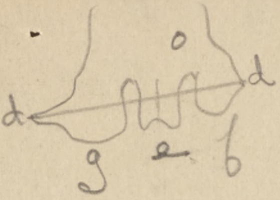
In size proportions the tarsus of Morphnus woodwardi to the tibio-tarsus which has been so designated is the same as Geranoaëtus melanoleucus. Further the bones somewhat resemble Geranoaëtus in build tho the position of the papilla to tibialis anticus on the tarsus — and the length of cnemial crests is different.

The tarsus & tibia of Wetmoregyps daggetti agree in proportionate size ~~of~~ with Urubitinga urubitinga.

Tarsus & tibia of Geranoaëtus grinnelli & of Geranoaëtus fragilis agree in proportionate size to Geranoaëtus melanoleucus.

Geranoaëtus grinnelli does not resemble G. melanoleucus in shape of either bone — as nearly as does G. fragilis

Neogyps errans — tarsus to tibia between Aquila and Haliaeëtus



e relative to breadth of dist. end is greater in vultures
e relative to other trochleae is:
1) relative to f, greater in vultures
2) " to g, greater in vultures
e is larger in vultures than in eagles

f relative to breadth – same in both
g relative to breadth – smaller in vultures

There is, in the vultures, a noticeable enlargement of the median trochlea (e) and a less marked? decrease in size of the internal trochlea.

★ → ~~Neogyps~~, ~~Th~~ the certain individuals of Neogyps ~~tending~~ slightly to have a larger median trochlea than the eagles, they are not ~~cannot~~ be placed with the vultures, in this regard.

The internal trochlea, however, is diminished as in the vultures.

e relative to breadth of distal end — eagles
e relative to f – greater than eagles – less than vultures
e relative to g – greater than eagles – less than vultures
g relative to breadth — vultures

internal trochlea (g) larger than ext. (f) in eagles
external trochlea (f) larger than ~~[illegible]~~ or equal ~~to~~ int. (g) in vultures
(except Neophron) all vultures have smaller internal than have eagles.

Notes on eagle humeri June 1927

a = Greatest length measured with deltoid side against calipers and back facing you.
b = Length of deltoid ridge – measured in above position
c = Breadth of distal end measured with opposite face against calipers
d = Breadth of proximal end – back face against calipers
e = height of process from distal end.
f and g = length and breadth of muscle attachment on distal end — No good as an indicator.
h = Length of proximal part on side opposite deltoid.
i = Distance from tendon scar to edge of facet (distal end)

Diagnostic for distal end in G. fragilis, Neogyps & Neophrontops is ratio of e to c. This does not, however distinguish G. grinnelli from Haliaetus – use distance from tendon notch to articular facet instead. (much less in Haliaetus than in G. grinnelli.) May use e to c ratio for G. grinnelli vs. Aquila (e greater proportionally to c in Aquila)

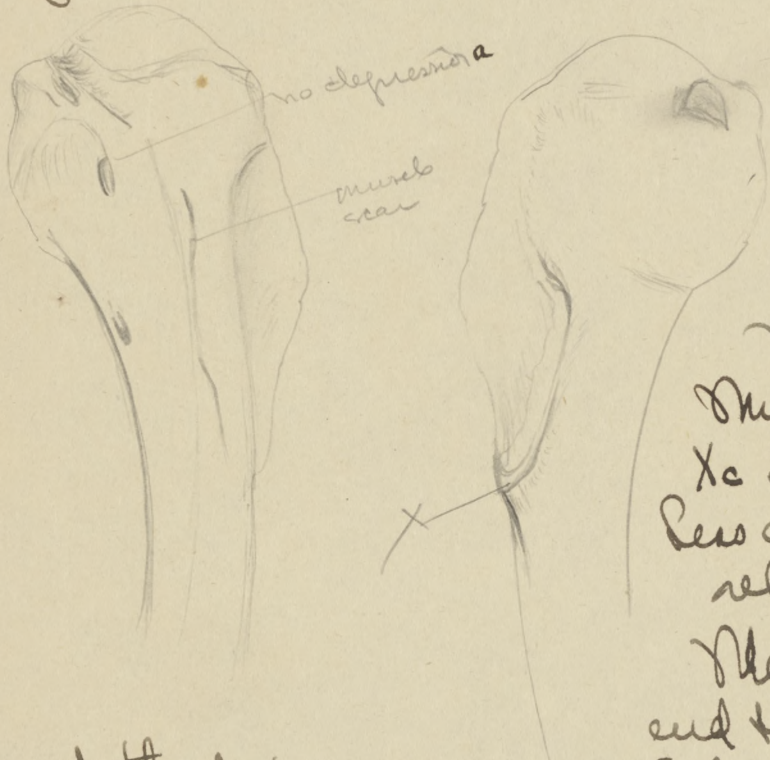
Proximal end ratios of d to b and h: Neogyps and Neophrontops similar, but shape distinct (Neophrontops looks more like G. fragilis) Both b and h in Neogyps are smaller relative to d than they are in G. fragilis (Neogyps b = d × 1.?, h = d – 1.? ; G. frag. b = d × 2.?, h = d – .?)

Humerus Eagles Lam

Questioned

3 complete.

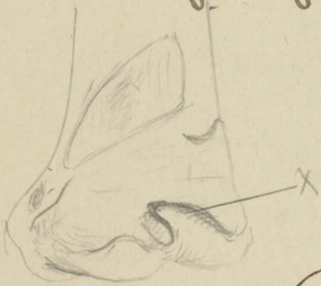
Stouter, tend to be longer also than Geranoaetus fragilis. Longer, but about the same build as Neophrontops.



X resembles Neophrontops most nearly

a - resembles Haliaetus most nearly the even ~~flattes~~ less depressed (unlike either Neophrontops or Geranoaetus

Muscle scar corresponding to Xc in G. fragilis shorter. Less curved than Neophrontops & relatively shorter ~~than~~ ~~it~~ also - Median muscle scar of distal end tends toward point distally and the depression tends to be but slight & in the center rather than at the edge as in Xd of G. fragilis. Quite unlike ~~def~~ scar of Neophrontops



Geranoaetus grinnelli? } or ?
Neogyps errans?

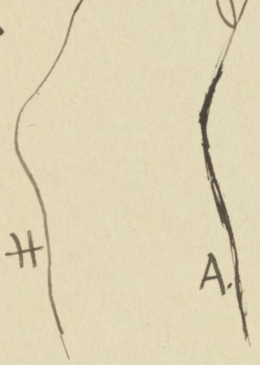
Humerus

Eagles & Hawks

Law

Haliaetus leucocephalus vs Aquila

Deltoid ridge →

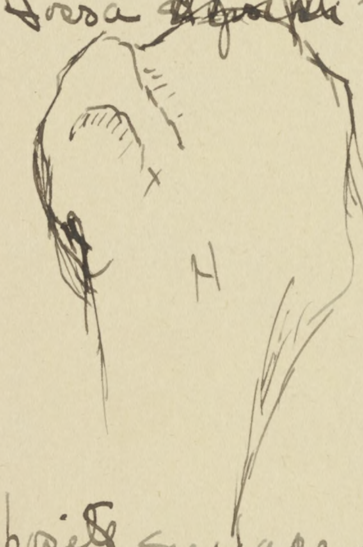


Prox. end

Ridge on opposite side longer in H. (extending 1/4 to 1/2 inch below distal border of fossa.

Fossa ~~deeper~~ not extended in H by ridge of shaft as in A

Fig 1.



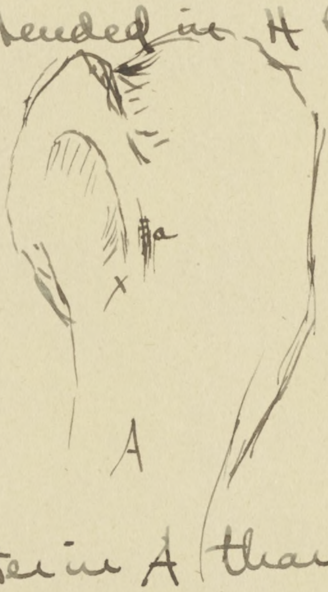


Fig. 2

Opposite surface flatter in A than in H

Distal end:–

Muscle attachment deeper toward ~~on~~ upper border in H than in A

Fig. 3

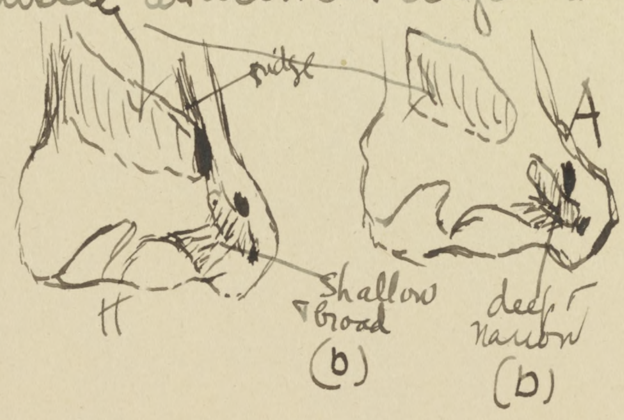
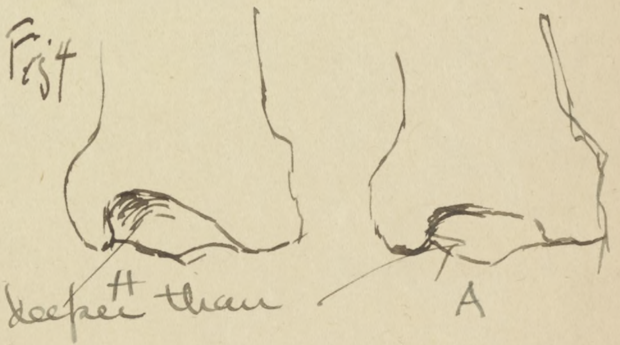
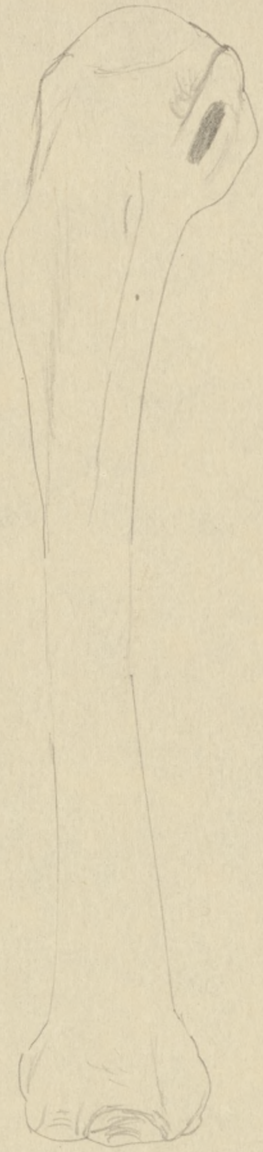
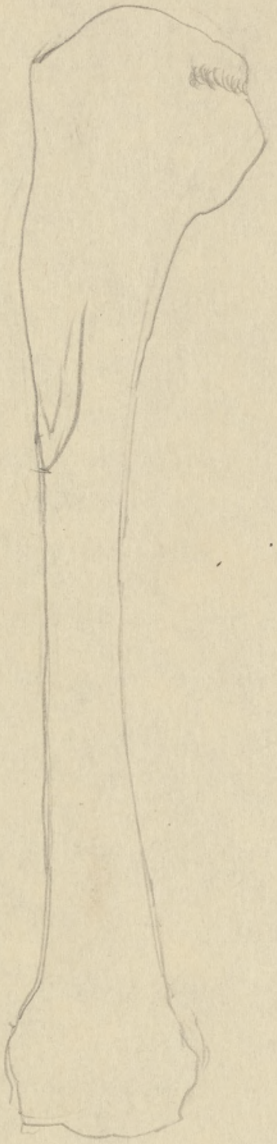


Fig 4







Distal end — humerus

Neogyps (etc) 5% (5.5 – 5.9%) 18.2 – 30.5

G. grinnelli etc 5% (5.4 – 5.7) 18.2 – 33.2

G. fragilis etc 6% (6.0 – 6.1) 16.6 – 27.2

Aquila etc 6% (6.0 – 6.2) 22.0 – 37.1

Haliaetus etc

~~Indented behind e~~

Geranoaetus grinnelli.

Aquila

Character of e —

High and narrow – Aquila

Low [illegible] – Ger. grinnelli } indented slightly

Low – Haliaeetus

Low – Morphnus – not indented

Low – Neogyps – ~~doesn't stand out~~ depressed at base

~~High~~ Low & narrow – G. fragilis – stands out

Groove on deltoid ridge side

narrow in Haliaeetus

broad in Geranoaetus

Brachial depression

Well depressed – Hal. Ger.grin., Morph

narrow ridge on int. side – Hal., Morph

broader, more rounded – Grin.

flat —— Neogyps,

Partially depressed Aquila

"i" —— very short – Haliaetus

less – G. grinnelli

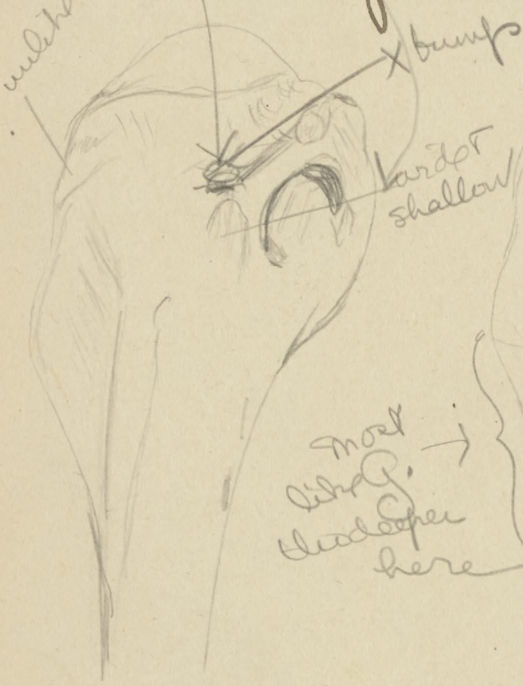
Morph – Aquila & Neogyps longest distance

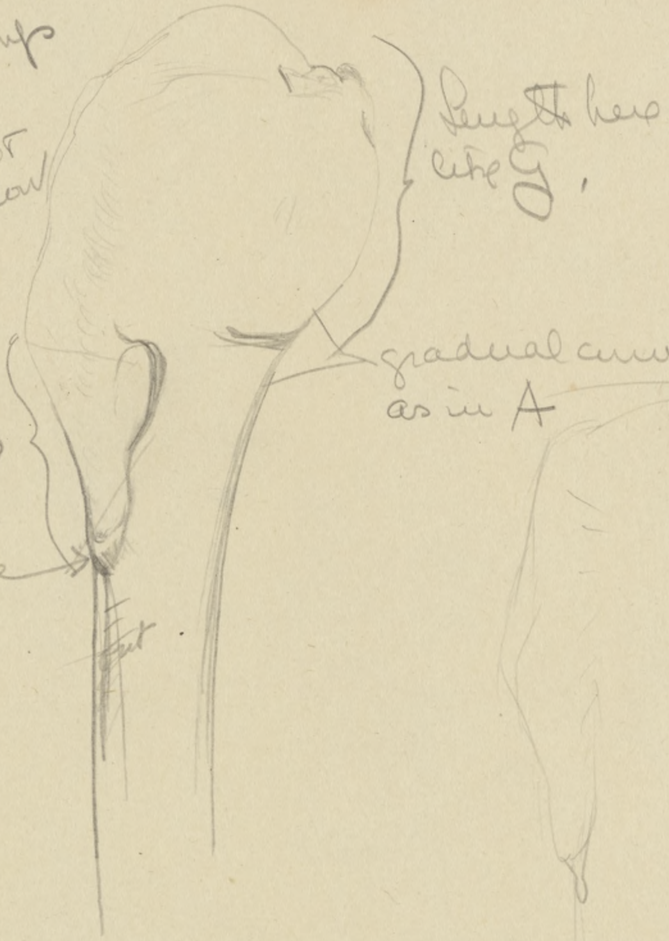
Humerus

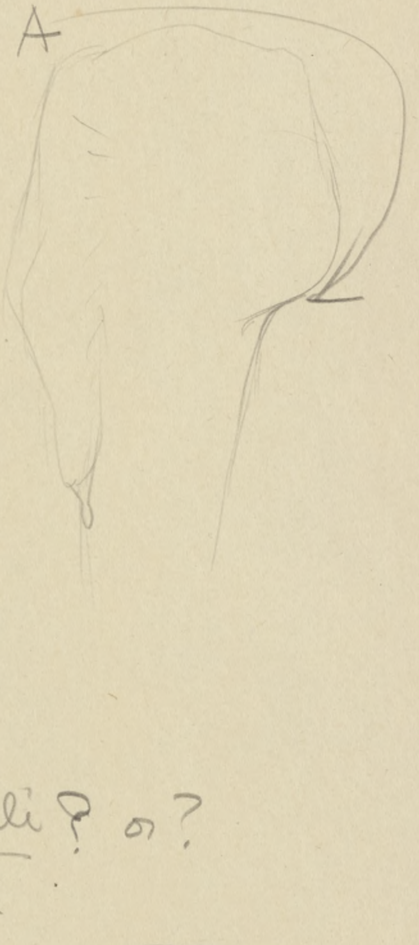
Eagles Sam

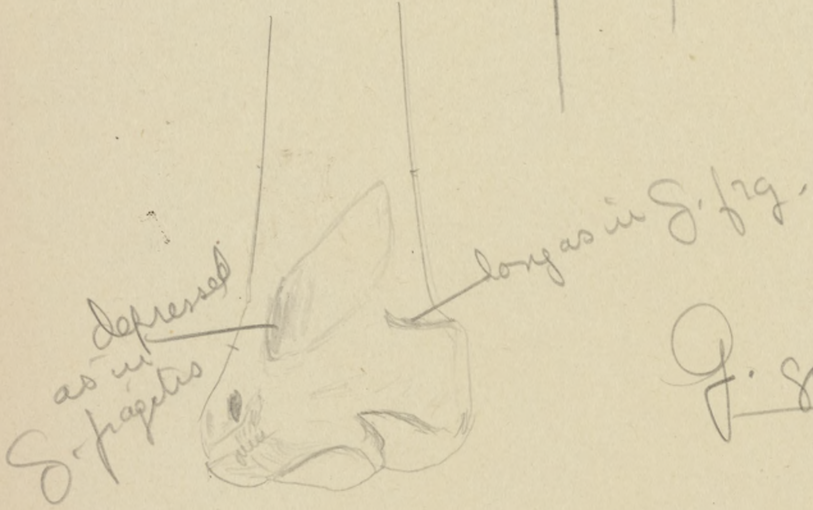
Questioned

4 complete:









G. grinnelli ? or ?

probably –
added → June 21, 1927
after seeing the material Howard

Neogyps errans 1928 Howard

Lam Lam

Humerus

Eagles & Hawks

Neophrontops ≠ Neophron in ~~[illegible]~~ length (possibly stouter) and length of deltoid ridge.

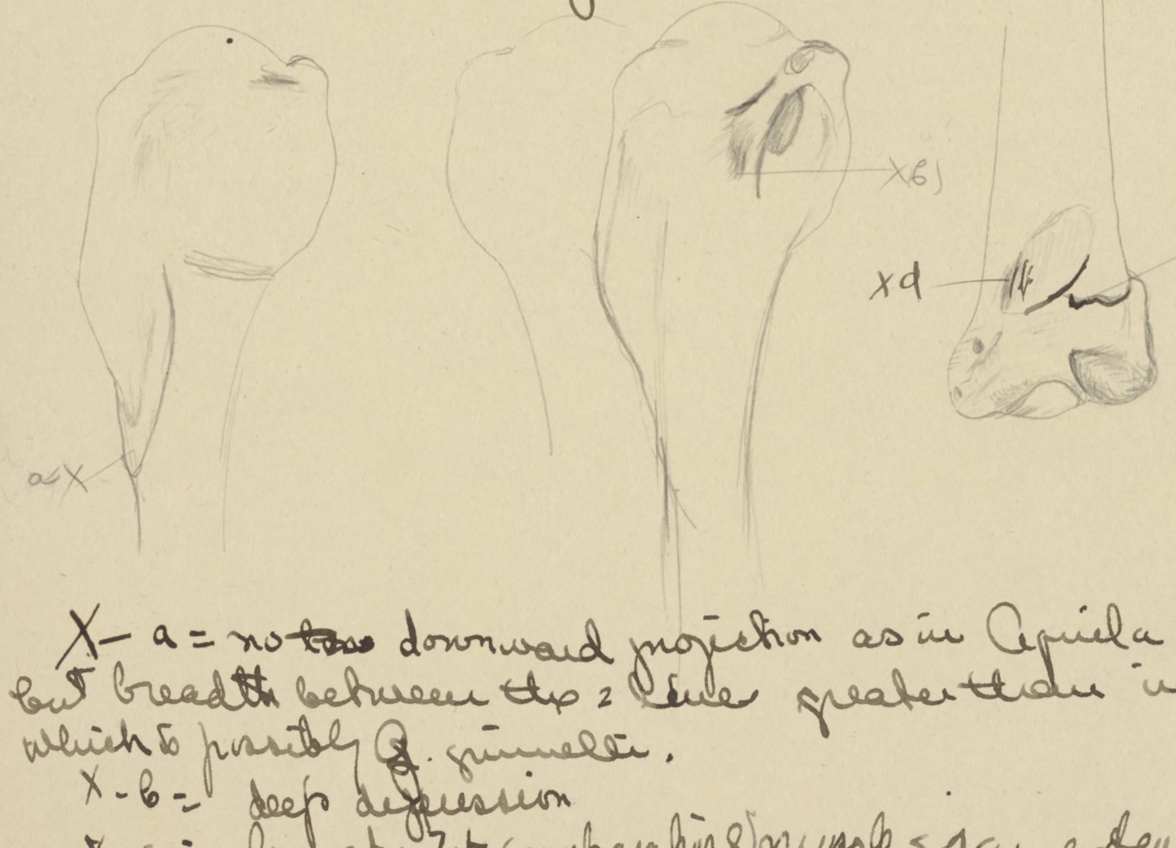
Prox. end:—
Large ridge on median side of fossa as in Aquila but more pronounced & with larger depression median to it. See fig.

2 X - a = (Haliaeetus page)

Distal end =
Lower side (opposite deltoid ridge) not produced to the degree found in A, H, or G. Opposite side:— place marked (b) in Fig. ~~3~~3 more nearly like H than A or G.
Deep muscle scar

distinguishes from Geranoaetus

Geranoaetus fragilis(?):—
Tends to be ~~smaller than modern G.~~ more slender than modern G.



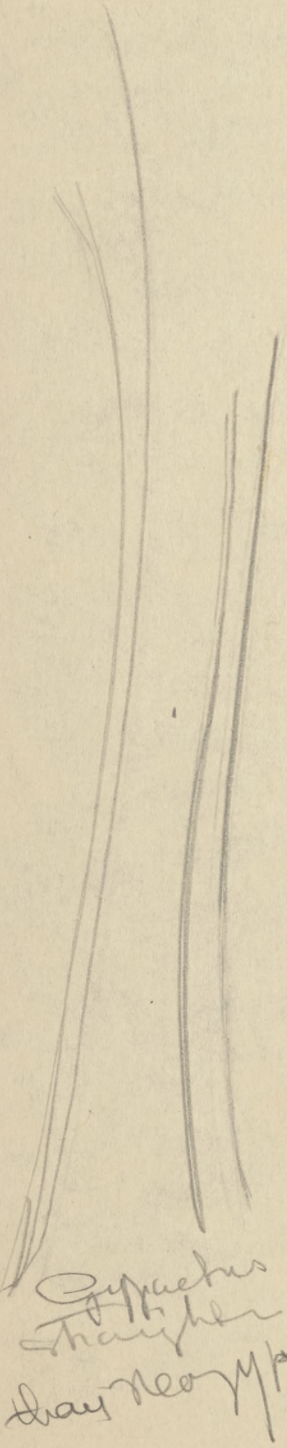
Resembles modern Geranoaetus

X- a = no ~~two~~ downward projection as in Aquila below this point but breadth between the 2 lines greater than in another one which is possibly G. grinnelli.

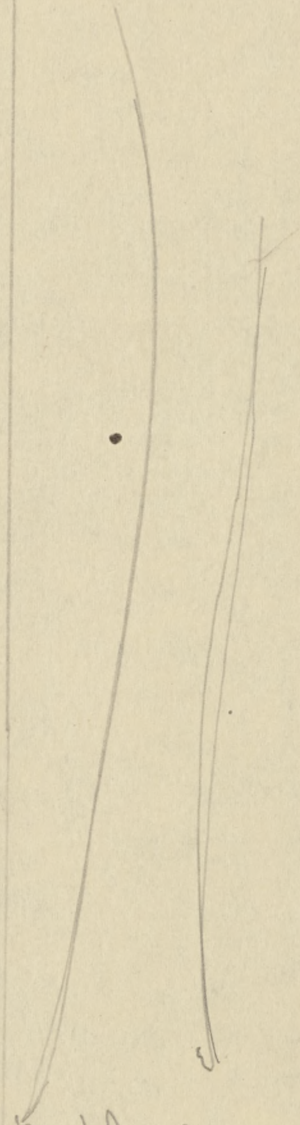
X - b = deep depression

X - c = long straight (comparatively) muscle scar extends from side to just below edge of large median scar

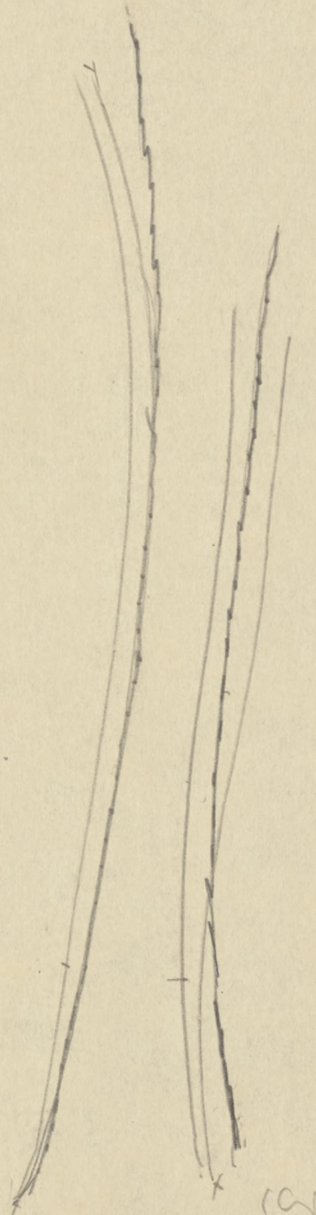
X - d = slightly depressed as far as ink scratches go.



Gypaetus straighter than Neogyps

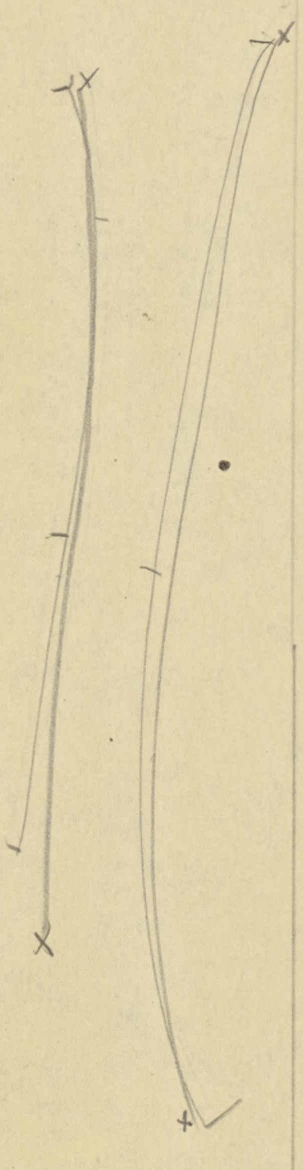


Morphnus straighter than Neogyps



Neogyps straighter than Otogyps

(Gypaetus is ~~[illegible]~~ omit it)



Humerus

① curvature of shaft: woodwardi straight~~est~~, fragilis next, grinnelli very curved.

② bicipital crest: woodwardi long and rounded down to shaft; fragilis short but rounding to shaft; grinnelli, short, broad and going abruptly into shaft.

③ Ectepicondylar prominence; woodwardi, medium
?
height, straight, unindented posteriorly, not protruding at prox. end; fragilis, medium height, straight (not all) unindented, prox. end protruding; grinnelli, medium height, not straight, indented, (somewhat) prox. end not protruding.

---

① woodwardi — Haliaeetus
② longer than Urubitinga but most like it in roundedness
③

---

① fragilis — Urubitinga
② Urubitinga — Buteo? (one indiv.)
③ Geranoaetus — Buteo (except not so long)

---

① grinnelli — Geranoaetus - Aquila - Buteo borealis
② Buteo? - Aquila?
③

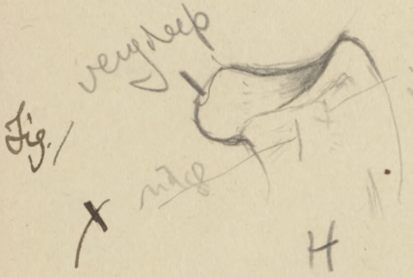
Femur

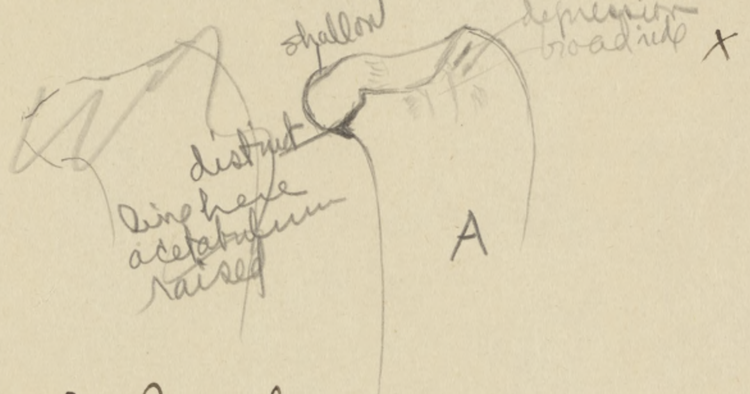
Eagle

Sam

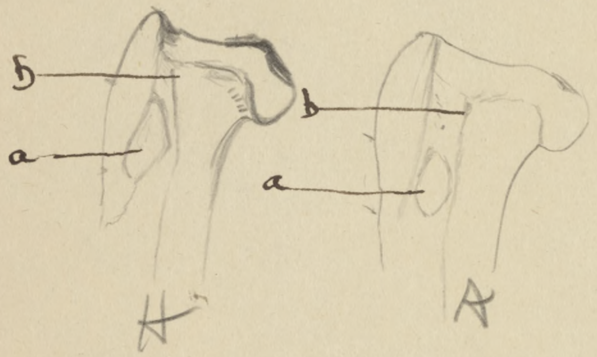
Haliaetus vs Aquila

Prox. end - articular surface - ~~de~~ depressed in center but rising to ridge on outer side in H - not in A.





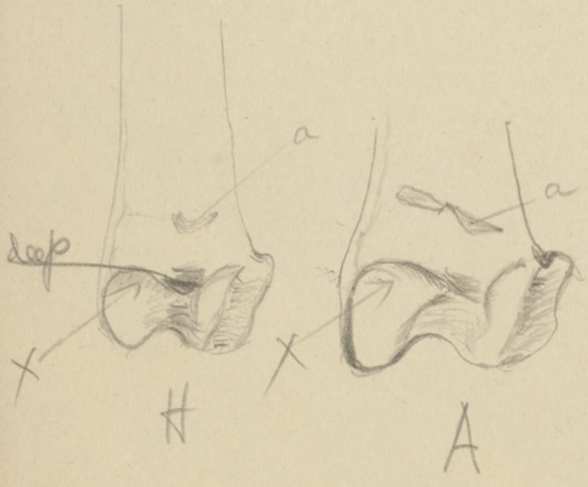
Anterior view of proximal end:-



Note position & size of a & position of b (further toward outer side in H.

Distal end:- Posterior view -

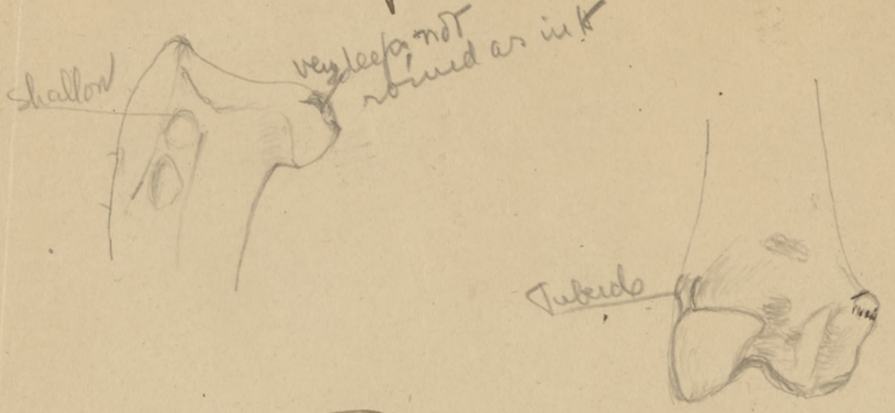
Note shape of x & a



Femur

Eagle L.A.M.

Morphnus woodwardi ? – 2 complete: (see last page)



Geranoaetus fragilis (?)

Two foramina on ant. side – prox. end as in ~~the~~ do above, but upper one more prox. in position

Muscle scar on ~~at~~ head deep & slit like (as above but not so deep)

Head prominent – center flat, ridge (small) at outer side

Smaller than modern G.

Neogyps errans (?) –

Smaller than G. (modern) but stockier.

Outer trochanter short but shaped like H. Foramen high as in H A Neo.

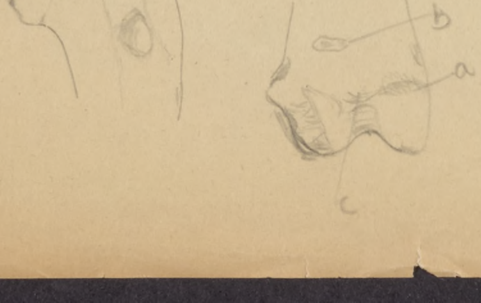
Position of muscle scar on head more as in A F. Neo. but deeper

Small outer ridge at articular surface (larger than A, smaller than H, not so marked as N.)

(a) varies some like H, some like A

(b) ~~Like H~~ more to one side than G, or H but sim. in shape.

(c) shallow, unlike H



Femur

Eagle Pam

Several large specimens – in general resembling A but on ant. surface of prox. end longer muscle ridge nearer outer side, and muscle scar of head deeper.

Ridge marked x in Fig. 1 more pronounced (sharper) than A.

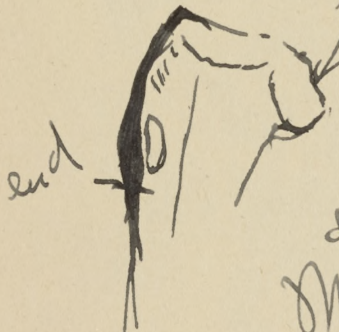
? Also look for ~~M~~ medium sized specimens with ridge as described above, but otherwise resembling A.

---

5 specimens resembling large size Geranoaetus. Possibly M. woodwardi but small. Note that of tibia there are 6 specimens of similar description.

G. grinnelli (?)

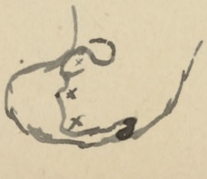
Size – medium Aquila. Very much shortened outer trochanter



Notch about as in Aquila, possibly higher

Distal end with small inner tubercle (not so well developed as in 5 specimens described above (M. woodwardi? or G. sps.?)

Muscle scar as in Aquila. Outer tubercle



note xxx – different than Aquila

~~E~~Eagles and Hawk

Tibiae:-

Aquila chrysaetos
Haliaetus leucocephalus
Geranoaetus grinnelli
Geranoaetus fragilis
Morphnus woodwardi

Haliaetus vs. Aquila:-

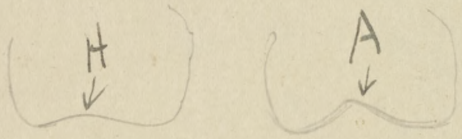
Cnemial crest ~~shorter~~ longer in H. and does not project forward so much as in A.

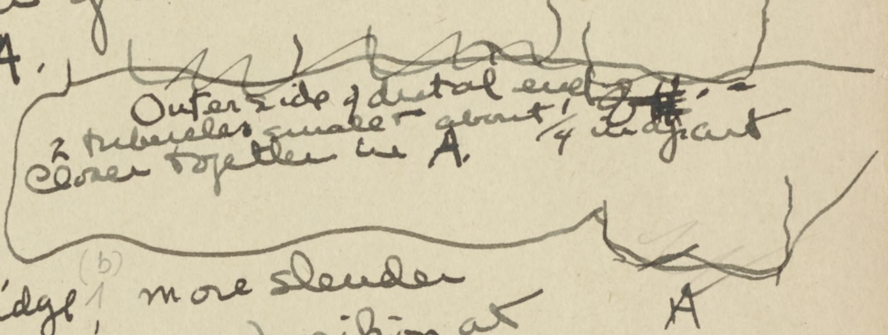
Proximal aspect of proximal end relatively narrow transversely in H.

Length about the same.

Distal end:-

Entocondylar groove shallow in H, deeper, & more angular in A.





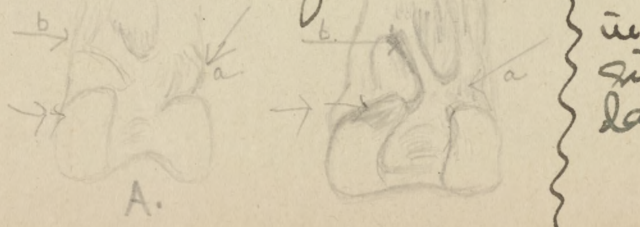
Outer side of distal end ~~H~~ - 2 tubercles smaller - about 1/4 in apart Closer together in A.

Osseous bridge, (b) more slender and more nearly median in position at its proximal end in H. (approaches the vertical in position, while in A., it approaches the horizontal.

Space between ectocondyle and lower border of upper fossa smaller in H., broader & flatter in A. See (a)

Entocondyle in H. less rounded, & turning abruptly ~~toward~~ toward middle of bone rather than gradually away in.

Tubercle on inner side not in center, but nearer upper side of condyle. Tubercle larger also (in H.)



Tibia

Eagles & Hawks Lam

Geranoaetus grinnelli(?) vs. Aquila:-

Prox. end:-

Short ectocnemial crest - convex antly.

Entocnemial crest about same length as in A.

but does not project forward so far

Size - about same length but gives impression of a more slender bone. Prox. end, prox aspect smaller.

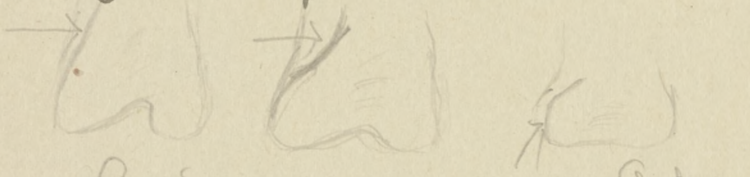
Long fibular articulation - ~~flat~~

Distal end:-

Deep, angular entocondylar groove, (deeper than A) more toward outer condyle.

Entocondyle more rounded than ~~as~~ in A. & does not turn in so much medianly.

Posteriorly - appears narrow & inner border of condylar surface does not turn abruptly inward.



Inner side:- Tubercle distal & back of center

Tubercles on outer side about as in A

Geranoaetus fragilis:-

Cnemial crests as in G. grinnelli

Fibular art. as in G. grinnelli

Smaller

Distal end

Shallow entocondylar groove

Tubercle on inner side large & forward & above center in position.

Tubercles of outer side close together

Posteriorly - inner side - border of art. surface not extending so far prox'ly as in G. grinnelli & more angular - see above

Tibia

Eagles & Hawks cont'd.

Pam

Morphnus woodwardi vs. Aquila & Haliaëtus:

Larger than either A. or H.

Cnemial crest relatively shorter than A or H. Actually about length of A

Art. with fibula elongated distally.

Distal end. §

Entocondylar groove shallow as in H.

Osseous bridge - size and position about as in A. but unlike A is more nearly flat. (A is convex).

Space between ectocondyle & lower border of upper fossa as in A. (broad)

Entocondyle rounded as in A. but not tapering off proximally as in A. (more suddenly chopped off)

Tubercle on inner side small and forward of center, in position.

Tubercles of outer side, (large) ridge - like & close together

"Tibia"

Eagles & Hawks cont'd

Lam

Questionable specimens:–

~~4~~5 (2 complete, 3 distal ends) "Too small for Morphnus woodwardi. cf Geranoaetus & Morphnus but too large for G.." Distal end of cnemial crest does not end abruptly as it does in Morphnus woodwardi

4 (3 complete, 1 distal end) "size nearest Geranoaetus fragilis but prox. end, outer side different"

write it out H. & G. & M.

~~6 prox. ends cf Neophrontops but much too large – size more like Neogyps. In tray with Neophrontops & Neogyps~~ = Catharista

Aquila chrysaetos	Ta	Ti	F	H
Haliaetus leucocephalus	Ta	Ti	F	H
Geranoaetus grinnelli	Ta	Ti		
Geranoaetus fragilis	Ta	Ti	F	
Morphnus woodwardi	Ta	Ti		H?
Morphnus daggetti	Ta			
Neophrontops americanus	Ta	Ti	F	H
Neogyps errans	Ta	Ti	F?	

✓ ✓ ✓✓ ✓ ✓

𝍸||||

✓ 𝍸 $\frac{1}{2}$ = $1\frac{1}{2}$ ✓ 𝍸| $1\frac{1}{4}$ = $2\frac{1}{4}$

✓ 𝍸 = 1 ✓ 𝍸 $\frac{1}{2}$ = $1\frac{1}{2}$ } $3\frac{3}{4}$

✓ 𝍸 = 1

$3\frac{1}{2}$

𝍸

$$\begin{array}{r} 3\frac{3}{4} \\ 3\frac{2}{4} \\ \hline 7\frac{1}{4} \end{array}$$

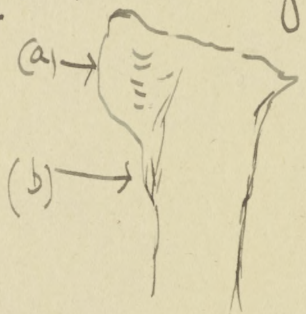
Tibia

Eagles & Hawks contd

Sam

Neogyps:
Short & stocky

Cnemial crest about the length of Aquila but the prox part (a) projects forward further than the distal part & then goes abruptly in to the small distal part (b)

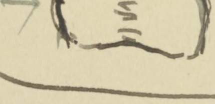


Distal end:— Relatively broad

~~to the long~~ Osseous bridge relatively short and tending to the horizontal as in Aquila.

Entocondylar groove shallow as in Haliaetus, Geranoaetus fragilis and Morphnus woodwardi

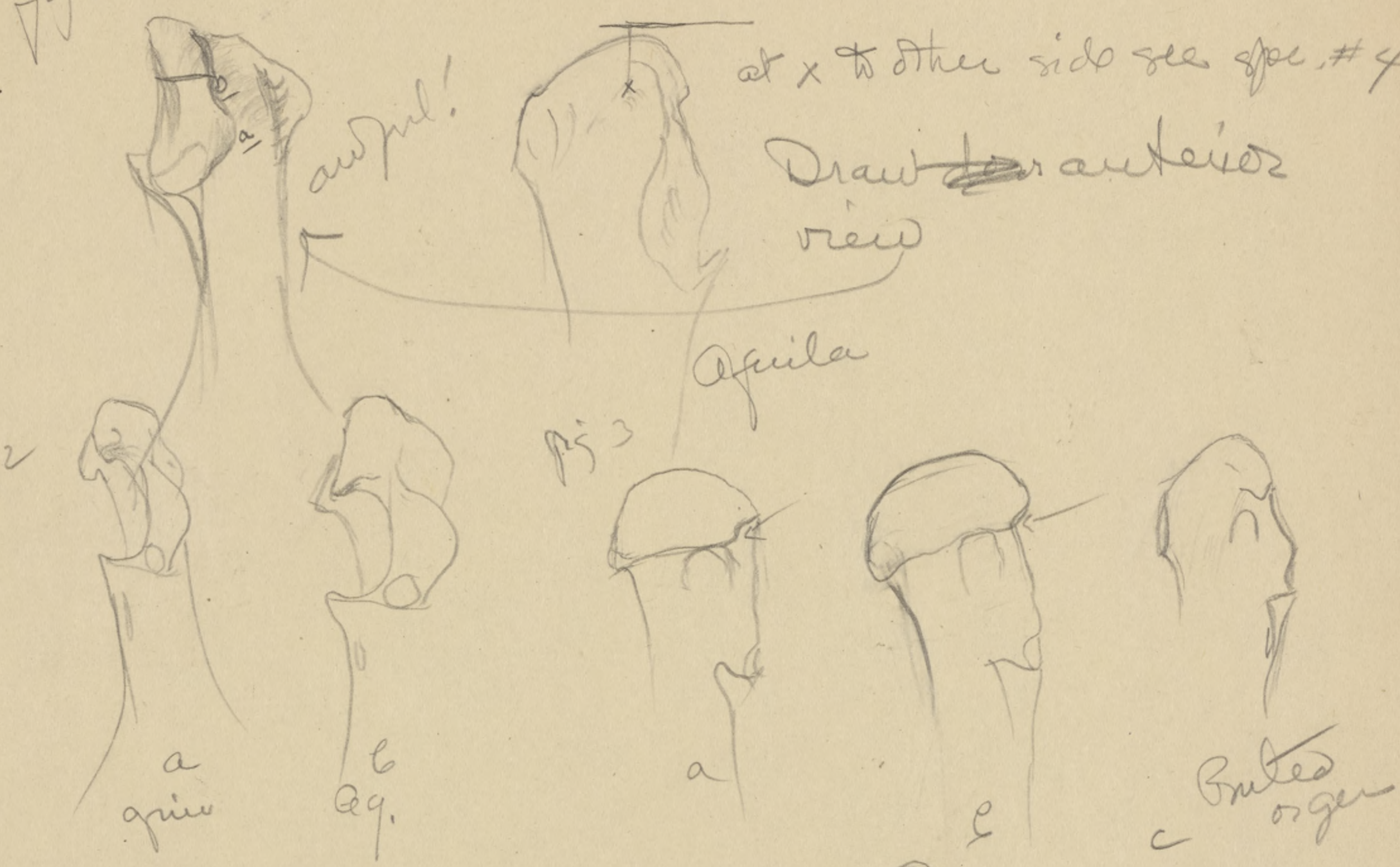
Tubercle on inner side large and nearly central in position (tendency to be forward slightly) Space around tubercle uneven and flaring posteriorly. due to enlarged inner border of articular surface which is of short ~~extent~~ prox'ly but wide & squares off abruptly



Tubercles of outer side small

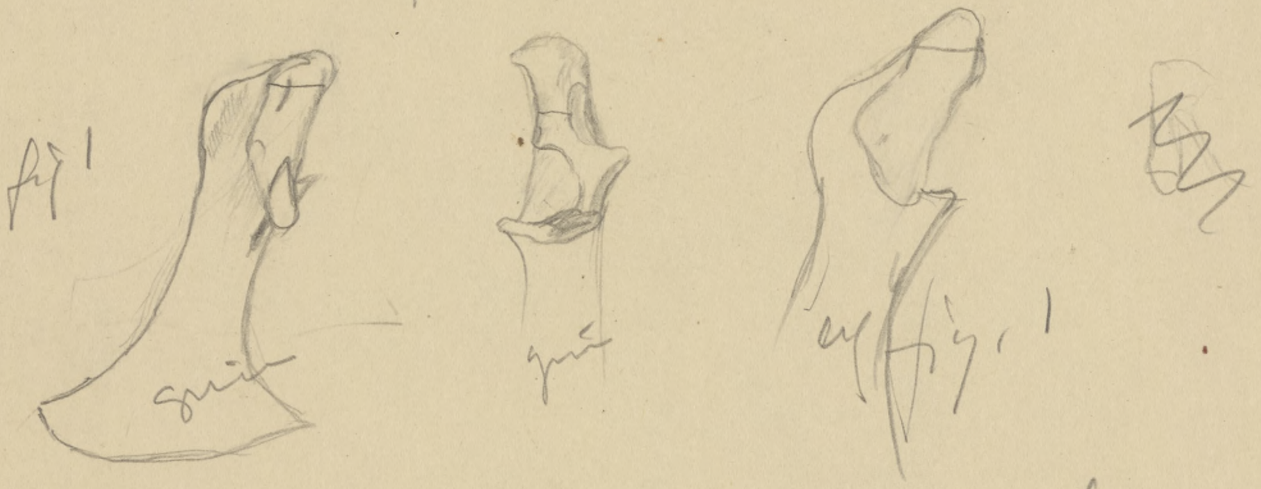
Neophrontops:—
Smallest,
Short cnemial crest
Distal end broadest ant.-posteriorly
Osseous bridge most nearly horizontal
Entocondylar groove shallow
Tubercle of inner side small & central but space is longer ant.-postly than in other eagles.
Tubercles of outer side ridge-like (fairly large) & close together

grinnelli
May 7 - 29



at x to other side see spec. #4

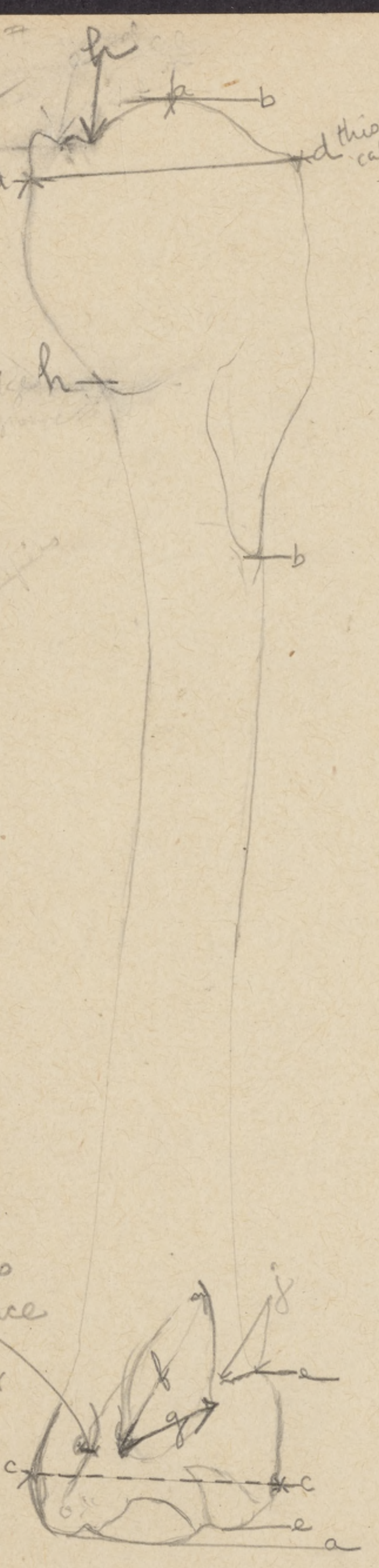
Draw ~~for~~ anterior view



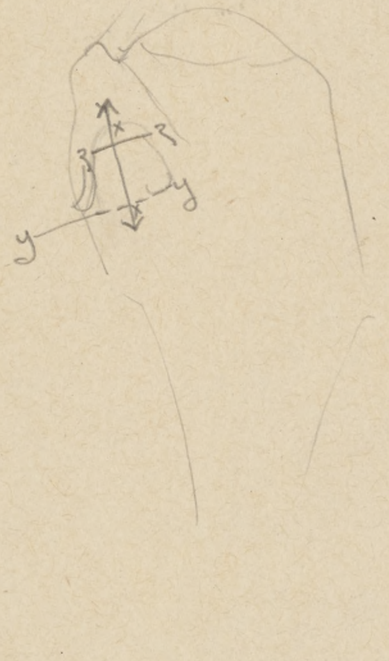
use Aquila #4 and
g. grinnelli #C5842

ant. view
int. "
dorsal "

June
1927
Larsen

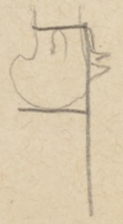


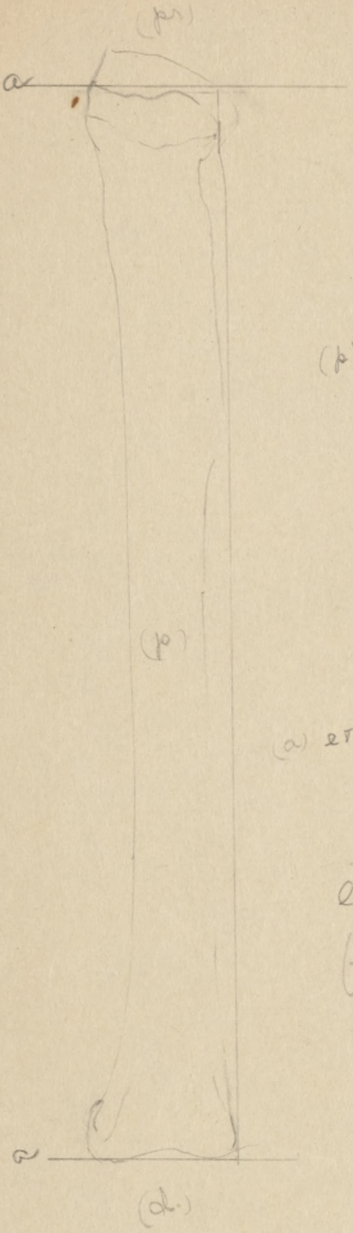
a Length
b Length of deltoid
— c Breadth of dist end
d Breadth prox end
— e Height of process on dist end
distal end { f. Length of scar
{ g breadth of scar

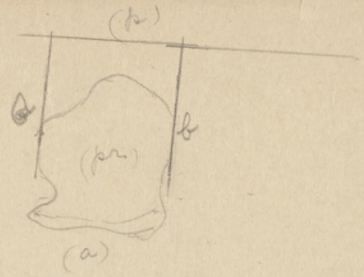


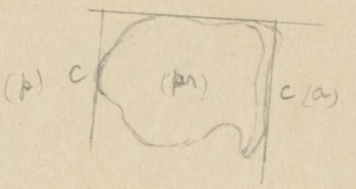
in grimelle
a = length
b = dist. breadth (c on drawing)
c = prox " (d on ")
d = delt. crest (b " ")
e = fcip " (h " ")

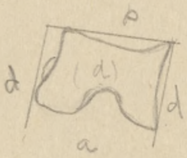
(e) turn on this side → with opposite side against edge.

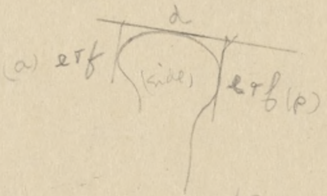




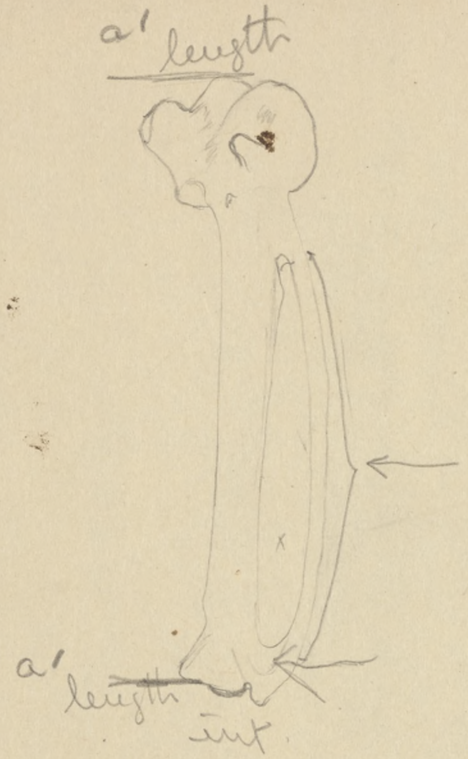


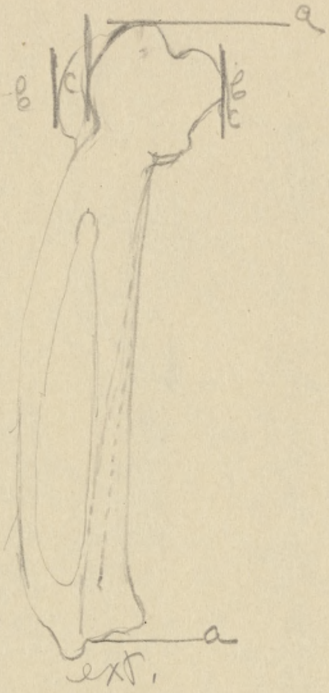






e = ext
f = int

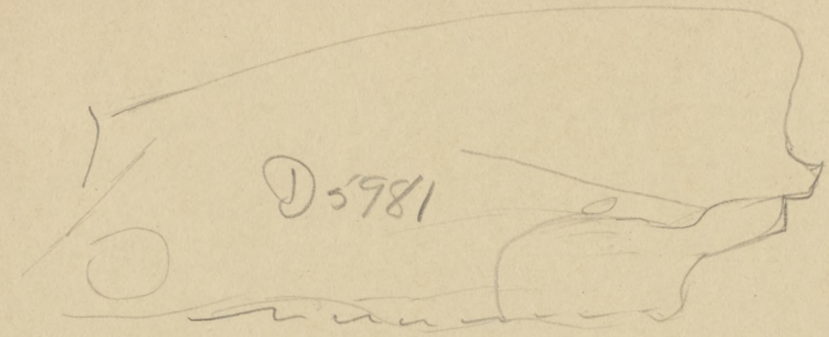




c 1587 grinnelli

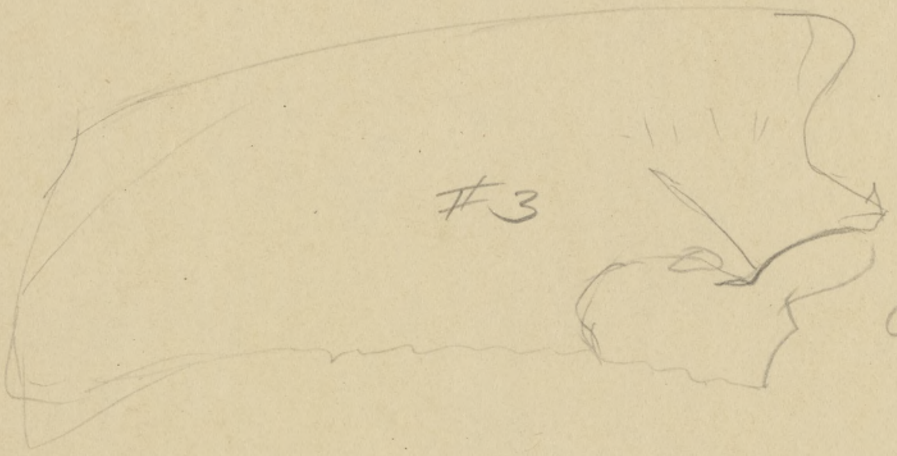
Gen.? and aq. (926)

a' length as taken in Haliaeëtus
U. fragilis
Sarcogyps
Gypaetus
species? (#232



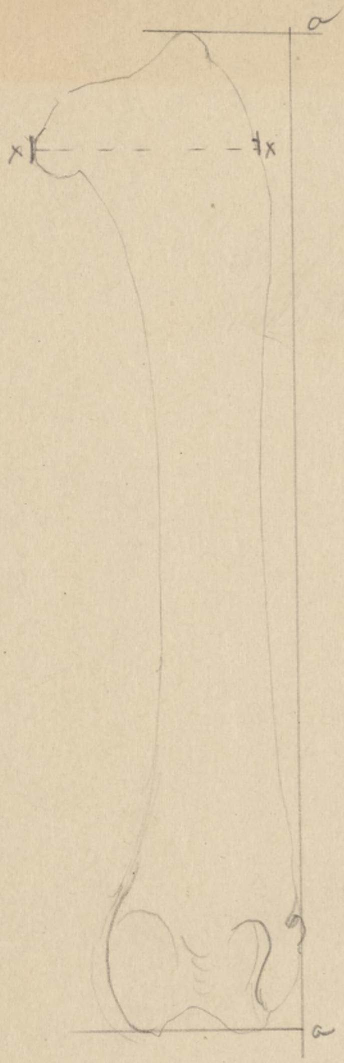
g. grinnelli

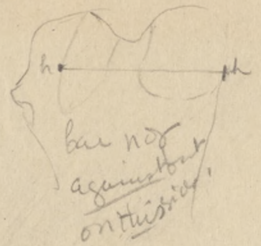
draw other side
up from rt side

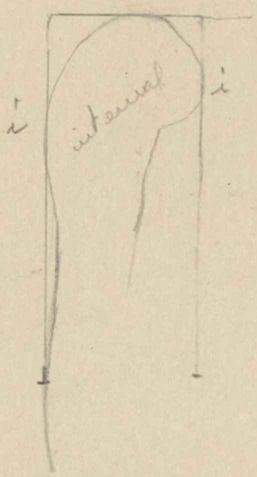


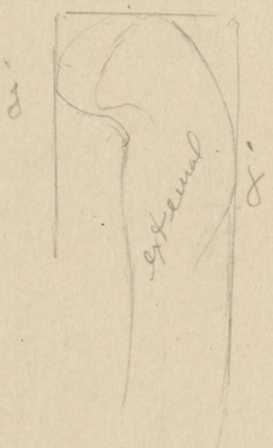
aquila

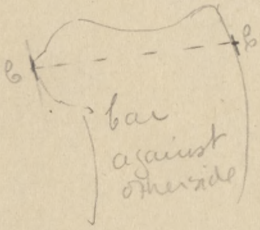
Photo ?





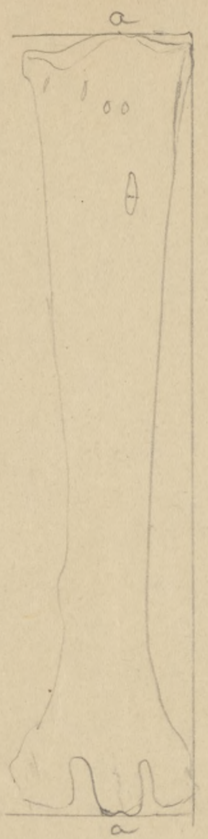


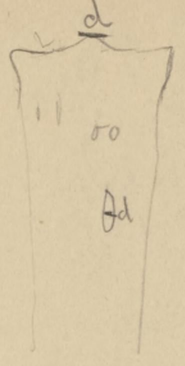


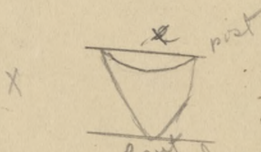


in Gimmelli
a = length
b = prox (x in drawing)
c = dist. (h " ")
d = int. cond. (i " ")
e = ext " (j " ")

these reversed in Spiz. & Heterospiz.

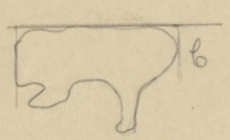


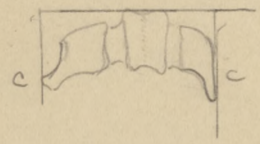


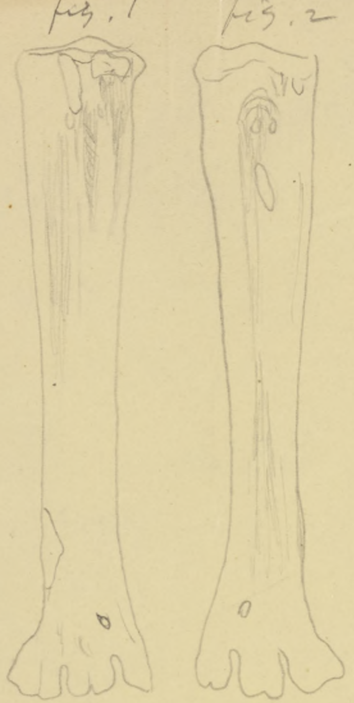


Cross section of shaft

greatest meas this way







pp 456—458
Same chars. in common with Gypohierax
pl. 183, figs. 1-10
(1-6 of type)

Palaeohierax Gervaisii (A. Edwards)
Miocene of Chaptuzat (Allier)

Gypaetus barbatus - in cave deps.

[~~un~~ très petite espèce de Vautour] M-E p 452

Lithornis vulturinus (Owen, Description of the fossil remains of a Mammal and of a Bird (Lithornis vulturinus) from the London Clay (Trans. Geol. Soc. Lond., 1841, t. VI, p. 208, pl XXI, figs 5, 6.
— Journal l'Institut, 1840 t. VIII, p 332
— Cat of the fossil Mammalia & Birds of the Mus. of the Coll. of Surgeons, 1845, p. 337

Gypohierax angolensis—
similarities with Gypaetus

vultures - sternum
costal facets (6) occupy $\frac{1}{2}$ lateral
edge only.

decided him against such a move.

The writer understands, also, that ~~the~~ late Dr. Suschkin expressed himself, (unfortunately only verbally) as of the opinion that ~~[illegible]~~ the R.L.B. vultures were not of the old world group. ~~Un-fortunately~~, [It] is regrettable that we have no record of this ~~view~~ opinion of an eminent paleornith. & authority on rapt[illegible] or of the reasons he may have had for his assertion. ~~The~~ ~~In view, however, of the evidence presented by the ~~e[illegible]~~ skeleton of Despite, the present writer can only believe that Dr. Suschkin did not have the opportunity of a.~~ ~~Dr~~ It was the present writer's privilege to ~~[illegible]~~ show Dr. Suschkin the material in the mus. coll. when he visited there in 192[illegible]. ~~At~~ At that time the entire skeleton of the various species had not been segregated and Dr. Suschkin was unable to examine more than the leg bones.

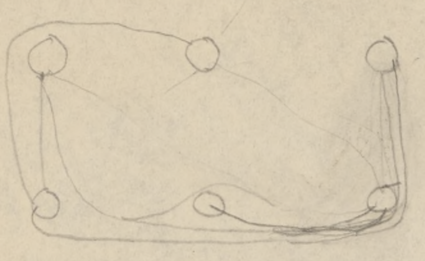
Buteo
    B. vulgaris 1800

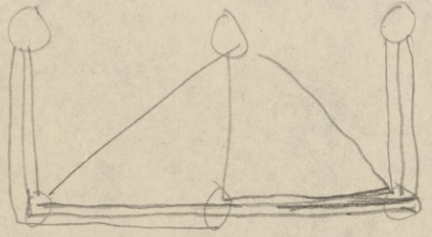
Geranoaetus
    G. ~~melanoleucus~~ aguia 1844
    G. mel 1855

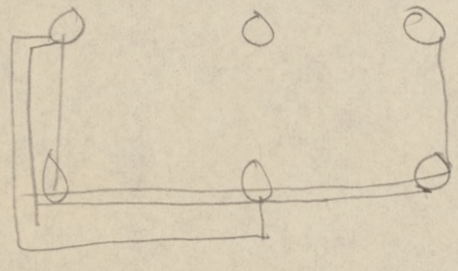
Urubitinga
    F. urubitinga 1788 was made type of genus in 1842
    F. anthracinus 1840 = U. anthracina 1848

Morphnus
    F. guianensis 1800 was made type in 1817.

Spizaetus
    F. mauduyti ~~1800~~ p 73 made type of genus in 1816
    F. ornatus 1800 p. 77 synonym of mauduyti?







Vultures	Eagles
2. Coracoid	
Furcular facet protruding ventrally in all but *Neophron*	Furcular facet never protruding ventrally
3. Furcula	
Symphysial region not recurved dorsally	Symphysial region recurved dorsally
4. Humerus	
Shaft near proximal end more flattened, less acute	Shaft near proximal end more acute
Distal end protruding about the same distance externally as internally	Distal end not protruding as much on external side.

Falconiformes

Accipitridae	– eagle –	Plio. Oreg ~~[illegible]~~	Miller Condor 1944
"	" + hawk	up. Oligo. Torrington, Wyo.	Wetmore Bull. Mus. Comp. Zool 1933
"	–	~~Low~~ Lower Miocene Agate Sprgs Neb. (?)	" Condor 1933 p 65
Aquila, sp.		upper. Miocene Snake Cr. Neb.	" Bull AMNH 1923 p. 504
Buteonidae, indet.		Lower Miocene, Low. Harrison beds Neb.	" " " " " 506
~~Bu~~ "	"	upper Miocene ? Snake Creek ? "	" " " " " 507
"	"	Lower Miocene, Bennett Co., So. Dak.	A H Miller UC Geol. p 91, 1944
Buteo sp.	(2 sps.)	Mid Miocene, Barstow, Calif.	Merriam " " 1919 p 462
"	"	Upper Pliocene, Meade Co, Kansas	Wetmore U Kans. 1944 p. 94
"	"	Pleistocene, Rancho La Brea	Howard also Miller 1925 p. 95 1930 Condor 84
"	"	" Carpinteria	Miller 1931 UC Geol p 364
"	"	" Florida	Wetmore 1931 Smith. Misc. p. 30
Buteo regalis ?		" McKittrick	Miller 1925 UC Geol p 323
Buteo swainsoni ?		" Samwel Cave, Calif.	" 1912 UC Pub p. 73
Circus hudsonius		" Carpinteria "	" 1932 UC Pub p. 364
Falco sp		" R L B "	" 1912 " " " p 78 (1925)
Parabuteo ? sp		Pliocene, Kern River "	" 1932 Condor p. 72

Eocene

	Eocathartes grallator	Wyo.	

Oligocene

	Phasmagyps patritus	Colo.	
	Palaeogyps prodromus	Colo.	
—	Buteo antecursor	Wyo (Torrington)	
X—	Buteo grangeri	So. Dakota	skull, larger than borealis
—	Palaeoplancus sternbergi	Wyo.	
	Accipitridae eagle & hawk	Torrington Wyo.	

Miocene

	Palaeoborus howardae	Dawes Co. Neb.	
	Palaeoborus rosatus	Bennett Co. So. Dakota	
	Proictinia effera	Harrison Beds Nebraska	
—	Buteo platypterus	" " "	
—	Buteo ales	" " " " " "	
? X—	~~Buteo typhoius~~		
	Buteo contortus	Snake Creek beds "	
X—	Buteo dananus	Loup Fork "	tibia 16.9 mm.
	Hypomorphnus enecta	Sheep Cr. " "	
	Falco ramenta	~~Dawes~~ Co. "	
	Accipitridae	Agate Sprgs.	
	Aquila sp.	Snake Creek "	
	Buteonidae, indet	Harrison "	
	Buteonidae "	Snake Cr. "	
	Buteonidae "	Bennett Co. So. Dak.	
—	Buteo spp. (2)	Barstow	

fossil raptores

Geranoaetus fragilis

A Dissimilarities to Urubitinga
- ✓ 1. Tarsus – length shape – position of tib. ant.
- 2. Tibia – relative breadth to length – (length of cnemial crest)
- 3. Femur – trochanter – iliac facet.
- 4. Scapula – straight sided glen facet, & acromion
- 5. Coracoid – furcular facet – coracoidal foramen
- 6. Furcula – indescribable

B Similarities to Urubitinga
- 1. Tibia – shaft
- 2. Humerus – curvature – shape of bicipital crest & deltoid crest
- 3. Beak – (something tho same – at least more so than G. mel.
- 4. Coracoid – dorsal side ~~at~~ post end (from muscle tubercle back)

C Dissimilarities with Buteo
- 1 tars shape – position of tib. ant. – length
- 2. Tibia – slight dep. prox'ly on outer side
- 3 Beak – indescribable
- 4 Humerus – curvature & bicip. crest
- 5. Coracoid – coracoidal foramen & dorsal side near dist. end
- 6. Scap – glen. facet

D. Similarities with Buteo
- 1. Tibia – shape dist. end
- 2. femur – iliac facet & troch.
- 3. Coracoid – furcular facet.
- 4. Furcula – gen. shape – tho broader

meas of Tarsus

Heteroopiz.	a Length	b prox	c dist.	d Inf	ba	ca	da
227378	104.2	13.5	15.3	14.1	12.9	14.6	13.5
U. am.							
16950	83.3	13.4	14.1	14.2	16.1	16.9	17.0
15618	88.3	13.5	15.1	14.8	15.3 2)31.4 15.7	17.1 2)34.0 17.0	16.7
U. u.							
738	119.5	14.7	16.0	15.7	12.3	13.3	13.1
17185	115.3	15.0	16.0	15.0	13.0	13.8	13.0
Ger.							
233	114.7	20.7	22.8	22.3	18.6	19.9	19.4
18471	105.0	18.7	20.0	20.7	17.8	19.0	20.3
U. pag.							
D 6868	119.1+	17.2	19.7	16.7	14.4	16.5 –	14.0 –
D 3645	101.9	16.8	20.0	16.8	16.4	19.6	16.5
J 9864	103.9	16.1 –	17.9 –	14.8 –	15.5 –	17.2	14.2
D 783	99.0 –	16.9	19.8	18.0	17.0+	20.0+	18.1+
G 2841	108.2	18.0+	20.6+	18.7+	16.6	19.0	17.2
Type UC 12757	112.4	18.	19.4	18.6	16.0 6)95.9 15.9	17.2 6)109.5 18.26	16.5 96.5 16.0

Measurements of coracoid

	a Length	b Br. prox	c Ht. prox	d brach & glen facet	da	db
Hanover	57.0	17.5	20.3	10.5	18.4%	60.0%
U. frag. max.	59.5					
min.	51.9					
D 2978	56.1	17.6	20.7	8.7	15.5	49.5
D 1272	56.1	16.7	20.0	9.1	16.2	54.4
H 4341	52.4	17.0	—	9.1	17.3	53.5
C 398	57.5	18.1	20.1	9.4	16.3	51.8
C 5931	51.9	15.6	19.1	8.9	17.1	57.1
(Gei. 233	61.3	19.4	20.9	9.5	10.5	49.0)
U. anth. 15618	41.3	12.0	13.1	7.0	16.8	56.4

~~A~~ i.e. Contour of furcular facet even, small pneumatic openings absent, greater ~~breadth~~ height of prox. end rel. to breadth; ~~height of prox. end~~ &, ~~being closer to resembling~~ first two ~~U. fr. anthracina~~ In these chars. ~~as is fragilis~~ both the cave spec. & frag. are closer to U. anth.

5.30
115 | 610,
575
350
345
50

~~[illegible]~~ fragilis

	mean	min.	max
Tarsus	105.4	96.3	113.4
Tibia	138.8	130.5	149.2
Femur	101.0	95.4	107.5
	345.2	322.2	370.1
Carpus	87.0	81.1	93.0
Ulna	191.7	182.2	201.2
Humerus	165.2	156.0	172.0
	443.9	419.3	466.2

max hum to ulna 85.4%
mean " " 86.1
min " " " 85.6

fem to hum /
max. 62.5
mean 61.1
min. 61.1

Ratio			
leg to wing	77.7%	76.8%	79.3%
Coracoid	55.1 mm	51.9	59.5
cor. to wing	12.4%	12.3	12.7
cor. " leg	15.9%	16	16

Morphnus

Tarsus	131.5	125.0	140.6
Femur	126.5	124.2	130.7
Tibia	177.7	171.4	190.8
	435.7	420.6	462.1
Carpus	116.3	104.4	128.4
Humerus	206.3	193.1	217.5
	322.6	297.5	343.9

June '27
Sam

Eagle humerus G. fragilis

#	a	b = d×2 +(?)	c	d	e	h = d-?
C7904	169.6	59.5	26.7	—	15.8	28.6
D8248	165.1	59.8	27.1	30.3	16.2	29.0 l
C4213	171.3	l 61.7	27.2	29.7a	16.6	30.1 l
F2068	158.0	l 57.6	25.0	27.9a	15.0	27.8 l
D2968	159.1	58.6	26.5	28.7	15.7	28.7
C2540			28.4		17.5	
C4573			25.7		15.1	
E2514			28.3		17.0	
E4679			26.6a		16.1	
D3028			? 28.6		? —	
D7059			25.7		15.5	
D6864			27.9		17.0	
C2763			26.2		15.7	
D1235			28.1		16.5	
C8582			28.4		16.9	
D 361			27.1		16.6	
C4284			27.2		17.0	
C7716		61.0		28.5		28.4
D1236		64.1		30.8		29.9
D7020		—		28.9		28.9
F 650		60.0		30.1		30.9
C2734		62.0		30.6		29.2a
D8919		56.9		26.8		27.3
D3090		59.0		28.5		30.0
E2636		61.9		28.4		28.8
D1825		58.0		28.6		28.3
E3418		61.0		30.3		30.6
D2670		64.0		29.9		29.7
C2838		—		28.5		28.2
C8610		63.7		30.4		30.6
C2547		—		30.9		30.9
E1110		63.5		30.5a		30.0
E4153		—		29.7		29.0
D7713		59.2		29.8		28.7
E2962		58.2		27.6		27.9
C1463		—		29.6		29.8

pelvis – fragilis

Ischium – inner side with ridge (longitudinal) not present in Gen.; closest in Uru.

Dorsal view nearest Uru in long narrowed line of iliac crests.

Ilio-ischiatic fenestra close to but not identical with Gen.

Transverse processes on synsacrum nearest Uru in size & position. Shape of centrum of post synsacral thoracics like Gen., however

---

carpus frag.

like Gen.; intermetacarpal space narrower distally than in Hetero or Uru.

---

tarsus – Hetero
tibia – Gen
humerus Uru & Hetero
cran. Hetero & Gen
teeth Hetero
furcula – Gen
mand. – Gen
pelvis Uru & Gen
carpus. Gen

20

138.8 = M
Shaft Tibiotarsus

fragilis

E4167
E4165 → 139.3 left
E1138 131.1 rt
C3731 149.2 left
C7332 148.5 left — typical - with fibula mount 17.2 (dist end)
E4598 134.3 rt — 15.2
E2572 136.8 rt
C4615 146.0 rt 9.5
C3490 134.8 rt
C5511 140.2 rt 8.8
D3104 140.1 rt — 17.5
D1677 142.0 rt 8.9
D4847 139.2 rt — 9.0
C3718 140.8 left — 8.6
E2880 134.5 rt — 8.1
E1226 130.5a left
D7541 132.9a left — 15.7
E2623 137.7 left ← 8.4
F2112 134.0a rt
~~D807 135.7 left~~
D2083 148.6 rt

Total 2352.6
135.7
+48.6
139.3
2776.2

mount 2776.2 → 17.2 (dist. breadth)

~~146 | 145 | 144 | 143 | 142 | 141 | 140 | 139 | 138 | 137 | 136 | 135 | 134 | 133 | 132 | 131~~

149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130
		1		3				1			1			1		1			
149.2	148.5 148.6		146.0				142.0		140.2 140.1 140.8	139.2 139.3		137.7	136.8	135.7	134.3 134.8 134.5 134.0		132.9	131.1	130.5

149.2
130.5
20 — 8.7

carpometacarpus fragilis

33 mean = 87.0

E4351	83.6	slightly less than average (.6 mm. [illegible])
C9667	86.0	
C9401	91.7	X
C4725	87.4	
D 803	87.8	
C5815	86.4	✓
C4448 ?	93.0	—
D154	82.5	
E4592	81.1	—
E3206	84.2	
C9296	87.1	-
D3057	88.3	
E1091	86.0	
C8454	92.6	X — mount
A2090	87.9	
E1516	81.3	
D183	92.3	X — mount
C8884	88.2	
B9506	90.0	
C4446	86.3	-
D2829	86.6	
J9406	87.1	✓ typical
E3166	81.3	
B8910	90.9	
D1942	87.3	
J8737	88.9	
D 379	83.6	
B9321	86.4	✓
C1846	89.0	
D6934	90.3	
E3419	88.6	
D1991	87.2	✓ typical
C6031	82.9	

mount ✓'s

ulna

201.2
182.2
(19.0)

2) 38.34 (+91.7
2
18
3

81	82	83	84	85	86	87	88	89	90	91	92	93
81,1	82.5	83.6	84,2		86,0	87,4 V	88.3	89,0	90,0	91,7	92,6	93,0
81,3	82,9	83.6			86,4	87,8	88.2		90,9		92,3	
81,3					86,0	87,1	88.9		90,3			
					86,3	87,9	88,6					
					866,	87,1						
					86.4	87,3 V						
						87,2						

93,0
81.1
11.9

43

mean = 55.1 mm

55.1
54.6

Concord

fragilis

slightly less than average (55.7 ff)

~~typical~~

typical mount

mount

D 816	55.5	
C 8395	53.9	
E 1464	52.5	
C 7557	59.5	*
D 5115	53.4	
H 4324	56.1	
C 5931	52.2	
H 4321	57.3	✓
C 6024	54.6	✓
H 4332	56.3	
E 4079	57.4	*
E 4148	58.1	
E 3943	54.0	
E 4028	52.4	
E 594	54.1	✓
E 1163	54.4	—
D 2825	53.7	
E 1576	55.6	
B 9850	57.9	×
D 2978	56.0	
D 1272	56.2	
J 9163	57.8	×
H 4341	52.2	
D 1503	53.0	
E 38	55.0	—
E 3942	53.0	✓
C 398	57.7	×
C 4987	56.5	
D 879	56.0	
E 3767?	52.7	
E 1577?	52.9	✓
E 1930	56.0	✓
H 4333	54.8	—
D 1124	51.9	*
D 1167	54.4	✓
E 3607	56.8	
E 4670	53.0	
C 9730	53.9	
D 4332	58.0	
D 9019	55.4	←
D 6990	55.7	
C 3847	57.5	*
D 8978	56.3	

~~59.5~~
~~51.9~~
~~4~~
~~2/11~~
~~55.7~~

59.5
51.9
7.6

26
29
55

2

51.0	51.5	52.0	52.5	53.0	53.5	54.0	54.5	55.0	55.5	56.0	56.5	57.0	57.5	58.0	58.5	59.0	59.5
	51.9	52.2	52.5	53.4	53.9	54.0	54.6	55.5	55.6	56.1	56.5	57.3	57.4	58.1			59.5
		52.2	52.6	53.0	53.7	54.1	54.8	55.0	55.7	56.3	56.8		57.9	58.0			
			52.7	53.0	53.9	54.4		55.4		56.0			57.8				
			52.9	53.0		54.4				56.2			57.7				
										56.0			57.5				
										56.0							
										56.3							
	1	2	4	4	3	4	2	3	2	7	2	1	5	2			1

165.2 = mean humerus fragilis

~~smaller ones~~

~~best specimens~~

C 7934 169.4

D 8248 165.2 —— Mount D 8248 ~~D~~ typical and mean

D 2968 159.7

C 4213 171.2 —— mount

F 2068 158.2

C 8735 159.2

D 1235 173.9

7)11568(165.2

B 8625 172.0 ?

C 2116 165.2 ?

C 8582 167.5 ?

C 2763 156.0 ?

11)18175(165.2

159.

11

71

66

57

57

25

193.1
173.9
9.2

173.9
156.0
17.9

156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173
156.0		158.2	159.2 159.7						165.2 165.2		167.5		169.4		171.2	172.0	173.9

6.0

45 left

Tarsometatarsus

pugilis

M = 105.4

D 4805	102.9 ~~99~~ left	
E 1574	106.7 left	
D 9494	106.3 left	
C 6555	110.1 left	X
E 1933	102.0 left	
C 6346	110.4 left	X
C 6845	109.2 left	X — mount
D 3164	104.9 left	
C 3860	106.1 left	
E 1579	105.4 left	
B 9930	109.6 left	X
G 2834	103.4 left	
E 4809	103.4 left	
G 2835	106.5 left	
D 6668	106.5 left	
D 149	106.8 left	
D 5786	106.1 left	
E 3043	103.6 left	
E 2608	104.1 left	
C 4889	102.7 left	
C 7597	106.2 left	
C 9774	105.5 left	
D 9859	107.9 left	
E 4507	107.2 left	
C 1920	105.9 left	
E 1447	102.1 left	
E 4793	101.4 left	
C 2019	109.7 left	X
E 1578	105.5 left	
D 1166	104.9 left	
G 2841	108.3 left	
D 9463	102.2 left	
D 1173	103.9 left	
D 343	106.8 left	
C 9377	106.3 left	
C 589	111.2 left	X
C 6655	108.6 left	
D 3600	110.4 left	X
B 8868	106.3 left	
D 3181	102.4 left	
D 3441	103.7 left	
G 2855	104.3 left	
E 787	106.6 left	
D 3604	110.4 left	X
B 9871	105.6 left	

$$\begin{array}{r} 113 \\ 96 \\ \hline 17 \end{array}$$

22

101.0=M

fagilis

Genus

~~(smaller than M)~~

C7957	103.3	rt	
E3759	98.7	rt	
E831	98.6	rt	
C8425	100.0	rt	~~typical~~
C9097	103.8	left	
F5437	97.8	left	
E4350	100.0	rt	
E1771	100.5	rt	~~— mount also D1819 left (broken but no left of this size are unbroken)~~
E2626	98.9	rt	
C684	106.2	left	— typical mount
C5857	97.7	rt	
D3433	103.7	rt	
D1350	97.4	rt	
E323	99.1a	rt	
C3463	107.5a	left	
F5416	101.5a	left	✓
C8273	106.6a	left	
C6823	104.6a	rt	— mount
E1965	98.6a	rt	
D6646	98.0a	rt	
~~C7511~~	~~106.2~~	~~left~~	
E2791	95.4	left	

95	96	97	98	99	100	101	102	103	104	105	106	107
95.4		97.8	98.7	99.1	100.0	101.5		103.3	104.6		106.2	107.5
		97.7	98.6		100.0			103.8			106.6	
		97.4	98.9		100.5			103.7			106.2	
			98.6									
			98.0									

107.5
95.4
12.1

Geranoaëtus fragilis

Tibio-tarsus.

Material available: 13 complete (one with fibula), 3 with proximal end broken, 13 proximal, 15 distal end.

	a	b	c	d	e	f	ba	ca	da	ea	fa	ed	fd	bc
C5511	141.1	17.5a	—	17.3	12.2	11.9a	12.4?		12.2	8.6	8.4	70.5	68.7	
C3731 ✓	149.6	—	—	17.6	12.4	12.5	—		11.0	8.2	8.3	70.4	71.0	
E1138✓	131.7	15.2	18.4	15.5	10.4	10.5	11.5	13.9	11.7	7.8	7.9	67.0	67.7	826
D1477	142.3	17.4	21.4	17.8	12.0c	12.2a	12.2	15.0	12.5	8.4	8.5	67.4	68.5	81.3
D4847	139.9	17.2	20.7	17.7	11.8	12.6	12.3	14.7	12.6	8.5	9.0	66.6	70.7	830
[illegible]	144.2	13.7	15.8	13.8	9.3	9.9	9.5	10.9	9.5	6.4	6.8	67.3	71.6	86.7

ba - Geranoaetus
ca — ?
da — OK but?
ea & fa Geranoaëtus
ed & fd eagle?
bc ?

Too much variability

12.2
12.5
11.7
12.6
4 | 490
122

Proximal end.

Like Geranoaetus Cnemial crest small	Unlike Aquila not so prominent	Unlike Geranoaetus	Like Aquila

Inner cnemial crest less prominent than Aquila, similar to Geranoaëtus; less deeply excavated on internal side, however — similar to Buteo in this.

Outer cnemial crest shorter and more curved than Geranoaëtus, and is convex anteriorly near the tip like Buteo.

Region distal to proximal surface on postero-internal side not deeply excavated as in Aquila. Near Geranoaëtus,

Distal end: — similar to Buteo in contour posterior side
Portion of int. lig. prominence ~~measure~~ · edge of condyle as in Geran;
but not as prominently pointed.

Supratendinal bridge more convex and not so nearly vertical in position as Geranoaëtus. Near Buteo.
Median-most margin straight as in Buteo — Geran.

meas. of tibia

	a	b	c	d	e	f						
	length	Br. prox	depth prox	B. dist	depth ext	depth int	ba	ca	da	ed	fd	bc
Hetero.	120.2	15.3 11.??	12.4	13.3	9.5	9.2	12.7	10.3	11.5	71.4	69.2	8.1 (Tm)
U. u. 738	144.2	13.7	15.8	13.8	9.3	9.9	9.4	10.9	9.5	62.3	71.5	8.6
U. am.												
15418	108.0	11.2a	14.7	13.0	9.3	9.0	10.3	18.6	12.0	71.5	69.1	7.6
16950	104.1	11.1a	14.6	12.6	9.2	8.8	10.6	14.0	12.1	73.0	69.7	7.6
Ger.												
18471	137.1	16.4	20.8	18.2	11.7	11.4	11.9	13.1	13.2	64.3	62.4	7.8
233	152.9	18.5	23.2	20.3	13.7	12.8	12.0	15.1	13.2	67.4	68.0	7.9
frag.												
C3731	144.6	—	—	17.6	12.5	12.4	—	—	11.7	71.0	70.5	
D4847	139.4	17.2	20.7	17.7	12.6	11.8	12.3	14.7	12.6	71.2	66.6	8.3
D1677	142.3	17.4	21.4	17.8	12.3a	12.1a	12.2	15.0	12.5	69.1	68.5	8.1
E1138	131.7	15.2	18.4	15.5	10.5	10.4	11.5	13.9	11.7	67.7	67.1	8.2

Br. to depth of prox end
with U. am & Het.

~~Br. of prox~~ end than G.,
or U. am or Het.

Br. prox. end = Ger., too large for U., to small Het.,
Depth prox = U. am. – too small Ger., too large U. u. or Het.
Br. dist = U. am & Het. – too small Ger. too large U. u.

Meas. of Tibia

	Length	br. prox art. surf.	depth prox	br. dist.	dept ext. cond	depth int. cond.
† Heterospiz.						

Neophrontops americanus

Neophrontops americanus, Miller, Univ. of Calif. Publ. Bull. Dept. Geol., 9, 105, 1916.

~~from Rancho~~

~~Neophrontops~~ Neophrontops has been described from three elements, the type tarso-metatarsus, ~~(type),~~ and ~~the~~ cotypes, tibio-tarsus and humerus, ~~all from Rancho La Brea.~~ In 1925 The species ~~has been~~ was cited from the McKittrick Pleistocene asphalt deposits* based on the tarso-metatarsus, tibio-tarsus, femur, coracoid and furcula, but none of these elements ~~have been~~ were described.

Miller (1916) assigned On the basis of characters of these elements, Neophrontops ~~has been assigned~~ to the family Vulturidae. ~~This assignment is borne out by a study of the entire skeleton~~ ~~principle~~

~~The present study which includes all of the principle skeletal elements, corroborates the evidence furnished by the tarsus, humerus & tibia.~~

~~In the present study the writer has endeavored to describe all of the principle elements of the skeleton and present a more or less complete picture of the bird.~~

~~Dist~~ Identification of fossil material

Identification of the various elements of Neophrontops offered no difficulty since ~~in~~ all three of the methods could be applied with unquestionable result: (1) relative abundance, Neophrontops is most abundant of all of extinct forms considered, being far above Neogyps ~~and~~ and G. grinnelli which are next in abundance; (2) resemblance to modern species, close resemblance to Vulturidae ~~Neophron~~ in ~~nearly~~ all elements and to Neophron in nearly all. 3) Size, smallest of all species considered.

---

*Miller, Avifauna of the McKittrick Pleistocene. Univ. Calif. Publ. in Geol. Scis., 15, 323. 1925

Neophrontops

Sternum

Material available: 42 specimens (5 practically complete)

~~In General~~

Resembling Neophron gingivianus in general characters.

Carina low, as in Neophron, ~~but~~ curved upward slightly at the anterior end, making this portion lower than in Neophron ~~approaching~~ ~~the degree of curvature present~~ ~~in~~ not as great as in the larger vultures, but more ~~so~~ than in Neophron; ~~associated with this curvature is the backward curve of the anterior margin of the carina and the general impression of a lower carina anteriorly than in Neophron~~ — anterior margin of carina ~~giving~~ concave anteriorly — Neophron more nearly straight.

		breadth across ventral lips of [illegible]	breadth of manubrium		ratio of b to a
1	E9851	35.7	5.2		14.570 —
	E3501	37.7	6.1		16.1
	D9482	38.5	5.2		13.5
4	C9768	38.3	4.9		12.8
	D7157	38.2	5.0		13.0
	D8266	37.1	5.0		13.1
5	C6534	39.3	6.7		17.0
3	F2324	37.9	5.4		14.2
	D8754	36.6	6.1		16.6
2	D7588	36.1	4.7		13.0
	D7690	37.8	5.1	32 139.5	13.4

14.3
11)157.2

128
170
142
3)430
14.3

128
170
142
145
164
5)751
15.0

128
170
142
145
130
5)715
14.3

~~Manubrium~~ ~~smaller~~ the ratio of its breadth to the breadth of the vent. lips ~~of~~ ranging from 12.8 to 17.0

Prominent flanges on outer portions of dorsal lips of coracoidal sulcus, as in Haliaeëtus; small protuberance only in Neophron, slightly larger in larger vultures. Absent (only a scar) in Aquila and Geranoaetus.

There appear to be ~~6~~ a tendency to have costal ridges in Neophrontops as compared ~~to~~ 5 in Neophron. This is true in ~~all~~ 5 ~~specimens~~ out of 6 such specimens and in this one exception the arrangement of the 5 is as in the others and not as in Neophron

with an av. of 14.1 as compared with 18.1 for Neophron. (See Table III Neogyps)

A comparison of size of elements of Neophrontops americanus and Neophron ginginianus

Note: The tibio-tarsus of Neophron is found to be about equal to the average of Neophrontops; thus, ~~giving~~ the ~~av~~average of the other elements will give a fairly clear idea of the relationship in size.

	No. of specs.	No. larger than Neophron	No. smaller than Neophron	Neophrontops max.	Neophrontops min.	Neophrontops av.	Neophron
Femur	72	72	0	83.4	71.9	77.5	61.2 s –
Tibia	46	20	26	124.5	109.5	117.0	117.2 ✓
Tarsus	167	167	0	97.2	86.8	91.5	81.3 s –
Humerus	42	8	34	148.0	134.9	141.2	145.6 l
Ulna	27	0	27	164.8	152.0	158.4	184.0 l+
Carpus	113	50	63	87.6	72.9	77.2	77.9 ✓
Coracoid	112	111	1	56.2	49.5	52.8	50.5 s
Beak least length	3	2	1	21.2	19.5	20.3	20.7 ✓
greatest length	3	0	3	30.6	30.2	30.4	40.1 l+
breadth	3	3	0	13.6	12.5	13.0	7.6 s –
sternum	1	4	7	39.3	35.7	37.5	38.1 l

Those checked elements of Neophron are close to average Neophrontops.

l = Neophron larger than average Neophrontops

s — 〃 smaller 〃 〃

✓s = 3
l = 4
s = 4

71.7
73.8
79.7
81.5
82.7
83.4
6)472.8
78.8

95
72
167

Table Comparing Size of *Neophrontops americanus* to that of *Neophron ginginianus*

Element	Number of specimens	Number larger than Neophron	Number smaller than Neophron	Neophrontops Max. (in millimeters)	Min.	Av.	Neophron	
Beak Greatest length	3	0	3	30.6	30.2	30.4	40.1	
Breadth	3	3	0	13.6	12.5	13.0	7.6	
Sternum (Breadth ventral lip of sulcus)	11	4	7	39.3	35.7	37.5	38.1	
Coracoid	112	111	1	56.2	49.5	52.8	50.5	l
Humerus	42	8	34	148.0	134.5	141.2	145.6	✓
Ulna	27	0	27	164.8	152.0	158.4	184.0	s
Carpometacarpus	113	50	63	81.6	72.9	77.2	77.9	✓
Femur	72	72	0	83.4	71.7	77.5	71.2	l
Tibio-tarsus	46	20	26	124.5	109.5	117.0	117.2	✓
Tarsometatarsus	167	167	0	97.2	85.8	91.5	81.3	l
Ratio of femur to humerus				56.3%	53.3%	54.8%	48.9%	
Length of leg				305.1	267.0	286.0	269.7	l
Length of wing				394.4	359.4	376.8	407.5	s
Ratio of length of leg to length of wing				77.3%	74.2%	75.9%	66.1%	
Ratio of coracoid to length of leg				18.4%	18.5%	18.4%	18.7%	
Ratio of coracoid to length of wing				14.2%	13.7%	14.0%	12.3%	
Ratio of humerus to ulna				89.1%	88.4%	89.1%	79.1%	

Aquila chrysaetos — femur L.A.M.

D4111	121.0	✓
F4604	120.9	✓
C 574	121.2	✓
F4381	120.6	✓
F4594	120.7	✓
F4646	120.7	✓
B9332	120.0	✓
F4385	120.7	✓
C2713	120.0	✓
C9146	122.0	✓
C 1341	120.5	✓
B9299	121.8	✓
C7303	122.1	✓
C4935	120.1	✓
C8739	120.5	✓
C4715	120.0	✓
B8547	122.2	✓
C4852	122.8	✓
C2073	123.0	✓
C4712	120.3	✓
C8727	122.8	✓
C3775	122.2	✓
C8842	120.6	✓
F4614	123.7	✓
F4608	124.3	✓
E5208	123.4	✓
C9041	124.4	✓
B9586	125.3	✓
F4611	123.7	✓
C2552	123.3	✓
D5200	124.7	✓
D6313	123.2	✓
C5474	124.2	✓
C 575	124.0	✓
C2018	123.0	✓
C1048	123.0	✓
B8396	125.2	✓
C4730	125.3	✓
C4770	123.5	✓
B9934	123.1	✓
D3841	124.6	✓
F4482	113.3	✓
F4481	117.9	✓
C6645	110.3	✓
F4384	115.5	✓
F4380	117.4	✓
D1939	116.8	✓
B8468	117.8	✓
B9579	116.1	✓
C8022	114.9	✓
C2658	116.6	✓
C2704	119.4	✓
D5452	118.1	✓
D5944	118.4	✓
C3542	114.9	✓
C3292	115.7	✓
C7670	115.6	✓
B9313	119.6	✓
C1023	118.8	✓
C9734	115.5	✓
D1025	116.6	✓
D 461	114.5	✓
C1041	119.4	✓
C3318	118.3	✓
C1015	117.6	✓
B8431	116.0	✓
C4585	118.8	✓
D1226	118.0	✓
C 768	117.5	✓
B9358	127.5	✓
F4383	126.5	✓
C 2168	129.39	✓
C 2966	128.1	✓
D3998	129.2	✓
C 1007	126.3	✓

→ 75

See separate folder
on complete data
on RLB Aquila

129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110

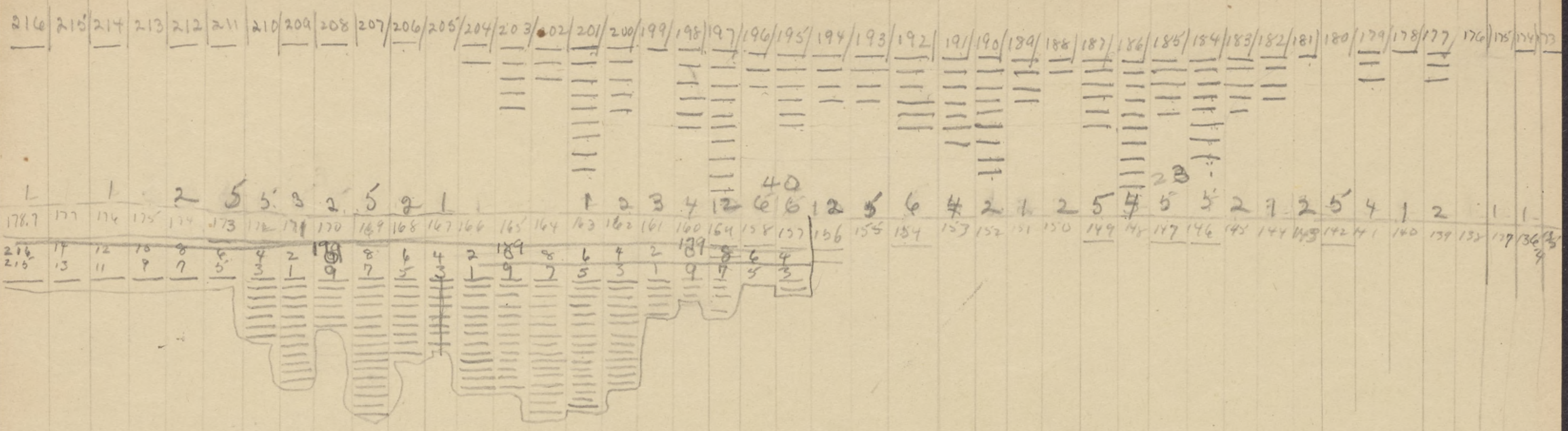
73 Aquila
femora

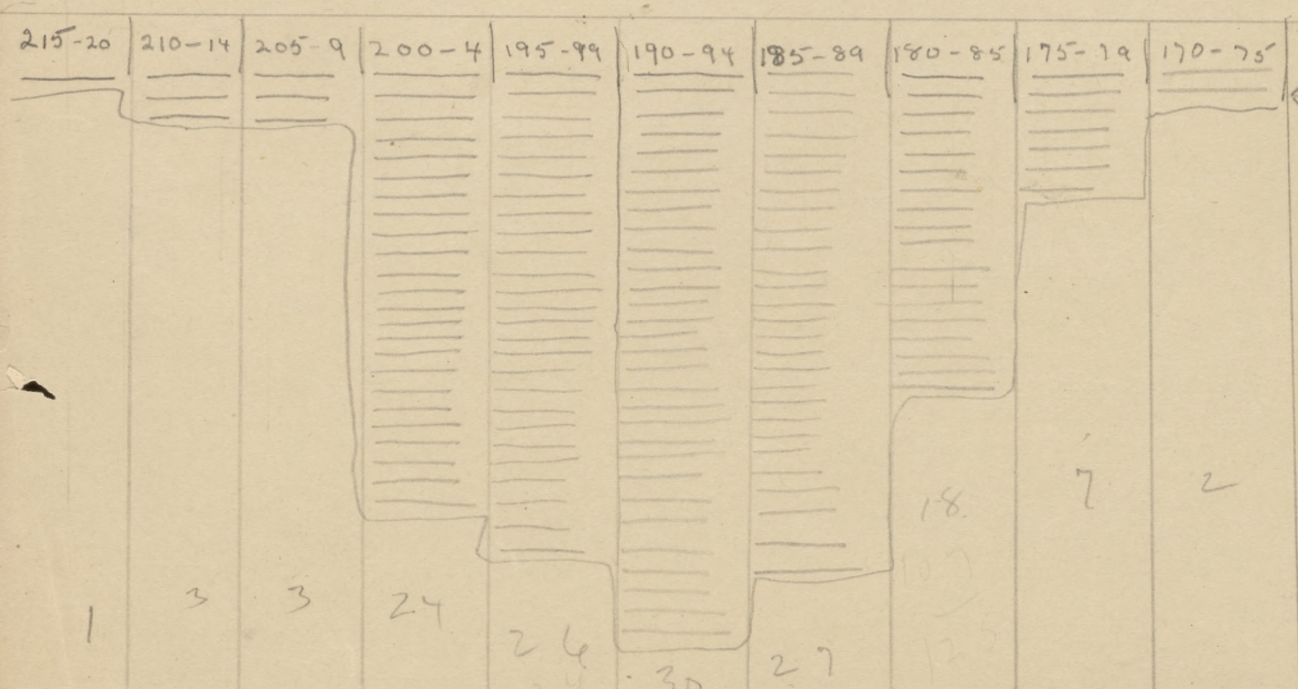
Measurements of humerus of Aquila chrysaetos from the asphalt pits at Rancho La Brea.

Length -- taken in millimeters

C1972	216.0
C2162	214.0
C1810	212.6
C1993	211.0
D1274	209.7
B8526	208.0
B9458	206.9
D3794	204.8
C 946	204.0
C2954	203.9
B9436	203.2
C4801	203.0
C7190	203.0
D1030	203.0
C3753	202.9
C7269	202.5
C1336	202.5
C4075	201.8
G1505	201.7
C4947	201.6
C1016	201.5
D3364	201.4
D1986	201.4
D5644	201.2
B9292	201.1
? C1993	201.1
C3611	200.1
C1804	200.1
C4802	200.1
C1152	200.0
C4024	200.0
C4979	199.0
C5778	198.7
C2025	198.6
D6579	198.2
G1503	198.2
C3688	198.0
G1504	198.0
D 684	197.9
C1973	197.8
C5199	197.8
C2663	197.7
C5693	197.6
C3034	197.4
D2478	197.2
C 340	197.1
D 863	197.1
C4680	197.0
C4786	196.3
C2436	196.3
C6319	196.2
C5152	195.7
B9435	195.6
C2957	195.5
C3239	195.4
B8853	195.3
C3156	195.3
C8340	194.7
C4859	194.4
C1940	194.2
C2667	194.0
C9022	193.8
D4759	193.5
B8381	193.1
C6759	193.1
C7267	192.7
C1863	192.5
C4980	192.2
C7468	192.1
D3425	192.1
C3171	192.0
C9699	191.9
C1813	191.9
C3160	191.8
D2661	191.2
D3387	191.1
D3477	191.0
C 941	191.0
C 951	190.8
D 984	190.6
D4856	190.6
D3413	190.5
C5942	190.2
C3182	190;2
C4098	190.2
C1870	190.2
C9578	190.1
C3070	189.9
D4928	189.9
C8561	189.8
C9659	189.1
B9295	188.4
C8647	188.2
B8388	187.8
C5889	187.7
C3038	187.6
G1717	187.3
D 601	187.2
C2991	187.0
C2060	186.9
C1045	186.9
B8386	186.9
C4099	186.6
C 936	186.5
C4604	186.3

C6418	186.2
C4066	186.2
C2064	186.2
C6653	186.0
C4717	185.9
B8387	185.8
C3033	185.6
C 948	185.3
C8945	185.2
B9451	184.9
C6799	184.7
C2057	184.5
C6419	184.5
C9534	184.1
B8601	184.1
D1332	184.0
D 217	184.0
D 367	183.9
D1306	183.8
C6253	183.7
C5176	183.5
C9663	183.1
C4080	182.2
C 947	182.2
D1953	182.2
B8424	182.1
D1302	181.8
C1065	179.7
C1080	179.6
G1520	179.1
B8385	178.1
C2674	177.9
C6517	177.4
D4438	177.1
C2026	174.2
C7910	173.7

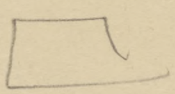




humerus ~~141~~ 140

Aquila

7-14-2

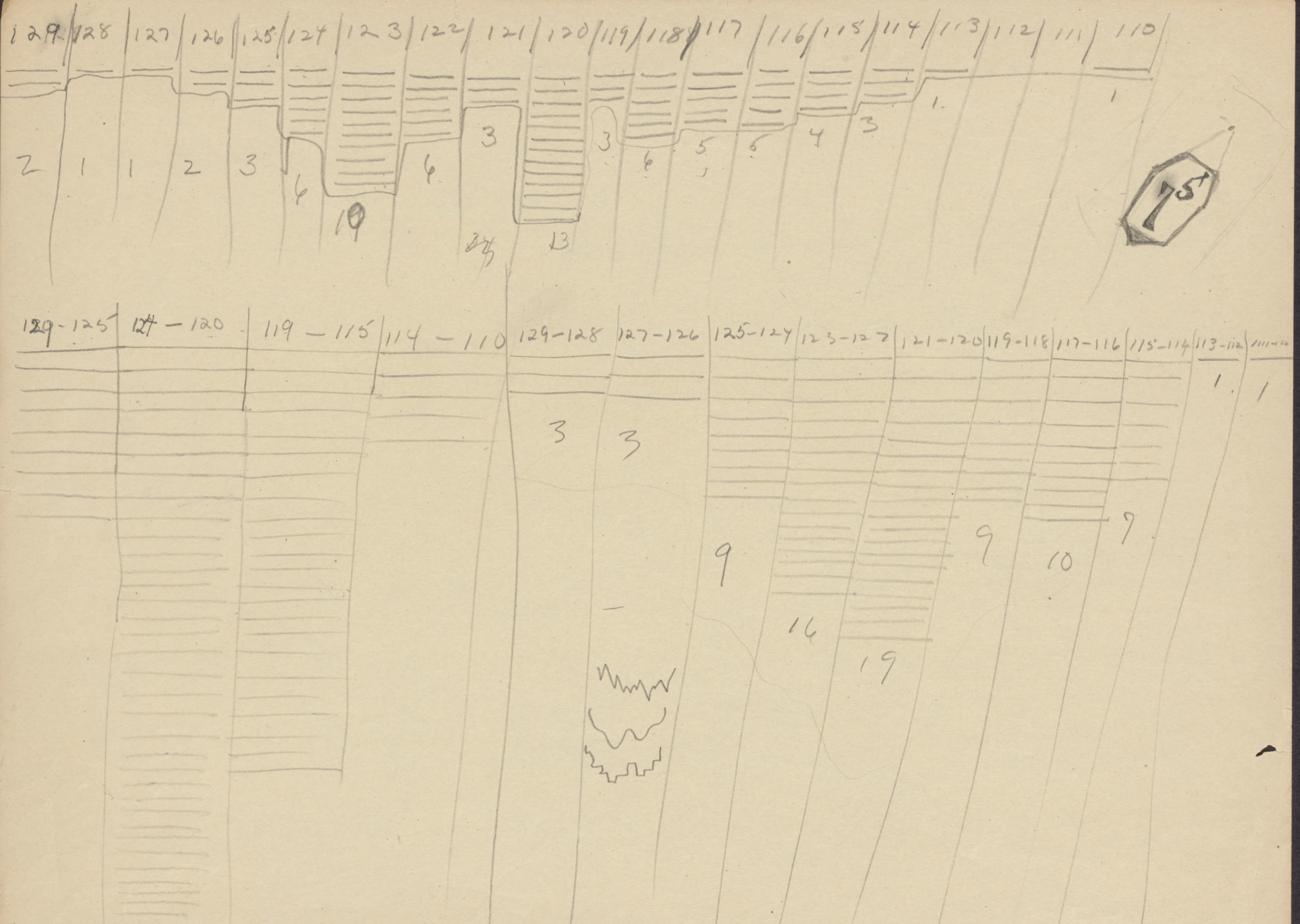


179.2
177.1
2.1

150, 141
14
127

216
173
43

177.1
179.2
2.9


129
128
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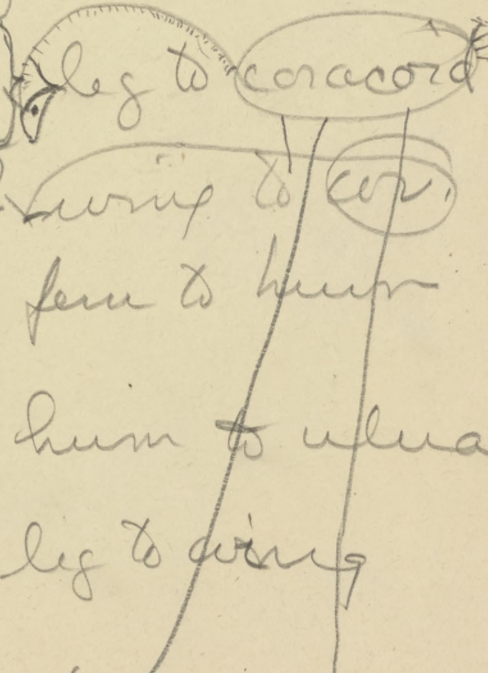
126
125
124
123
122
121
120
119
118
117
116
115
114
113
112
111
110
2
1
1
2
3
6
10
6
3
8½
13
3
6
5
6
4
3
1.
1
7st
129-125
124-120
119-115
114-110
129-128
127-126
125-124
123-122
121-120
119-118
117-116
115-114
113-112
111-110
1.
1
3
3
9
14
19
9
10
7
216 215 214 213 212 211 210 204 208 207 206 205 204 203 202 201 200 199 198 197 196 195 194 193 192 191 190 189 188 187

Aquila modern

max.	2nd max	min.	2nd min	
MVZ 42686 194.0	927 192.7	41410 171.9	923 178.8	humerus
42686 225.6	927 224.9		923 210.1	ulna
	927 179.2	41410 11.8.6	923 122.6	femur
42686 105.5	927 104.5		923 96.6	carpus
	927 165.1	41410 153.2	923 160.2	tibia
42686 106.8	927 104.8	41410 94.3	923 98.7	tarsus
	927 396.1	41410 366.1	923 381.5	length of leg
42686 525.1	927 522.1		485.5	length of wing
	927 69.5	41410 62.4	923 62.9	coracoid
	927 17.5%	41410 17.0%	923 16.4%	leg to coracoid
	13.3%		923 12.9	wing to cor.
	927 67.0%	41410 68.9	68.5	fem to hum
42686 85.8	927 85.6		923 85.1	hum to ulna
	927 75.8		923 78.5	leg to wing



Aquila L.G.M.

max	min	
216.0	173.7	humerus
244.1	211.9	ulna
112.8	92.5	carpus
135.8	114.0	femur
172.8	148.0	tibia
107.6	90.7	tarsus
416.2	352.7	length leg
62.8%	64.4	femur to hum.
572.9	478.1	length wing
72.6%	73.7%	leg & wing
76.8	61.2	coracoid
18.4%	17.3%	coracoid to leg
13.4	12.8	cor. to wing
88.4	81.9	hum to ulna
		~~leg to wing~~

~~165.6~~
100.1
14

[redacted]

71
65
.6

95.5
85.5
10.4

15.7
14.3
1.4

79.2
70.0
9.2

carpus — coracoid not alike = .6 [illegible]
coracoid — humerus OK
carpus — ~~tarsus~~ not alike
coracoid — ulna OK

D3473 75.9 — 76.8 C4608 — ~~77.0 C1862 — 77.2 4354~~
C7301 61.2

Modern Aquila

Humerus

MVZ41410 171.9
923 178.8
926 182.0
MVZ42686 194.0
927 192.7
679 180.2

194.0
171.9
22.1 mm variation

C1972/216.0
C7910 173.7
42.3

Tarsus

MVZ42686 106.8
927 101.8
923 98.7
~~421 100.0~~
679 101.0
926 99.5
MVZ41410 94.3

106.8
94.3
12.5

C2172 107.6
C2269 90.7
16.9

Carpus

MVZ42686 105.5
67[illegible] 100.0
926 [illegible]7.8 97.5
923 96.2 96.6
~~421 104.2~~
41410 — 94.0 ? (not present but estimated from tarsus
927 104.5

105.5
94.0 ?
11.5

C1138 112.8
C1346 92.5
20.3

ulna

42686 225.6
926 211.0
679 210.7
~~421 223.1~~
927 224.9
923 210.3 210.1

225.6
210.1
15.5

radius 189.4 = 41410
199.2 = 679
198.7 = 926
198.4 = 923
213.9 = 927
214.3 = 42686

42686 - Pescadero, Calif. Feb. 21, 1921
41410 — near Light - Cochise Co. Ariz July 7, 1919
679 - Ariz. Cochise Co. June 25, 1927 ?
926 Dry fork of Home Creek - Steens Mts., Harney Co., Oregon
923 Home Creek, Harney Co., Oregon Dec. 1928

femur

42686 – 130.5? not present merely an estimate
MVZ 41410 118.6
923 – 122.6
926 122.9 – 122.6
927 – 129.2
679 – ~~127.6~~

129.2
118.6
10.6

130.5
118.6
11.9

D 1320 135.8
D 860 114.0
21.8

---

tibia

4286 166.5 not present, merely an estimate
MVZ 414.0 153.2
923. 160.2
926 160.2 – 160.4
927 165.1
679 ~~160.4~~

165.1
153.2
11.9

166.5
153.2
13.3 ✓

C 3269 172.8
D 1363 148.0
24.8

Length wing		Length leg
923	485.1	381.5
927	522.1	396.1
926	490.8	382.8
679	490.9	386.0
42486	525.1	366.1 – 41410

Ratio of length of leg to length of wing

923 78.6
927 75.8
926 77.9
679 78.4

Dept. Vert Paleo,

Aquila antiqua — Am. Mus. Nat. Hist, Bridger
ungual — Church Buttes, Sinclair 1905

Aquila ferox — Am. Mus. Nat. Hist. Henry's Fork
Bridger
"perfect pedal phalangeal joint"
and "prox portion of claw"

Aquila lydekkeri — Am. Mus. Nat. Hist
Low. Cottonwood Creek
Bridger.
2 claws, 3 "pedal phalangeal joints",
dist. end tibio-tarsus
head of femur + its condyles
head tarsus & misc. bits of shaft of tarsus

Aquila pliogryps — Cope collection
Equus beds, Oregon
~~ungual~~
basal phalanx of hallux

Aquila sodalis
prox. fourth of left tarsus, Oregon (Equus beds)

35
25
60

600
535
25

665
25
6.40
25
6.15

+

-25

168
615
17405

168.60
25
.35

95 265

95
72
167

265
160
60)425
420

703
17405 7

167
705
174.05
168
6.05

72 160

3 /230
180
50
25
25

3.25
240
565

168
605
17405

D.P., Buteonids

Pedal phalanges

wt.?	a Length	b Prox.	c Dist.	ba	ca	d Br.	da
J 2001	29.3	14.2	6.9	48.5	23.5	6.6	22.4
Ern.							
D 2954	27.4	13.6	7.1	47.9	25.9	6.7	24.4
C 8091	27.7	14.1	8.0	50.9	27.8	7.1	25.6
B 9216	26.8	12.9	6.9	48.2	25.7	6.6	24.6
J 2255	28.6	15.4	8.2	53.9	28.6	7.9	27.6
J 2297	21.8 Hawk?	10.1	5.9	46.4	27.0	5.3	24.2
D 4231	26.7	13.6	7.8	50.9	29.2		
C 295	26.3	12.8	7.0	49.7	26.6		
D 4893	26.0	13.1	7.2	50.4	27.6		
C 8323	26.5	13.0	7.1	49.1	26.8		
J 2086	27.2	14.2	7.7	50.4	28.3		
ok J 2293	26.6	12.8	7.0	48.5	26.3		
J 2295	26.2	13.1	7.0	50.0	26.7		
ok D 2100	26.6	13.6	7.8	51.1	-		
D 6871	25.6	12.4	4.9	47.4			
J 2294	26.9	12.8	6.7	47.7			
ok D 3734	27.1	13.8	7.2	49.8			
ok J 2089	27.0	13.7	7.7	50.7			
ok C 3974	27.1	13.3	7.7	49.1			
ok C 6735	24.7	12.9	7.1	52.3			
ok J 2088	26.0	13.0	7.6	50.0			
ok B 2911	25.4	12.9	6.7	50.8			
C 9255	24.5	12.2	6.3	49.7	25.7	5.8	24.6
D 3774	24.5	11.6	6.2	47.4	25.3	6.2	25.3
C 7373	24.3	11.7	6.8	47.1	27.9	6.1	25.1
D 4202	23.0	11.4	6.3	49.6	27.3		
C 178	23.9	11.6	6.2	48.6	25.9	5.9	24.7
J 2290	24.3	11.4	6.1	47.0	25.1	6.0	24.7
J 2291	24.8	13.4	6.6	54.0	26.6		
ok J 2311	24.2	11.5	6.0	47.5	24.8	6.1	25.2
ok J 2299	24.8	12.3	6.0	49.6	24.2		
C 5646	23.8	12.5	7.1	52.6	29.8		
ok D 3750	23.8	11.4	6.3	47.9	26.5		
ok D 4566	24.0	11.7	5.9	48.7	24.6		
ok J 2913	24.7	12.8	6.7	51.8	27.1		
ok D 4619	24.1	11.4	6.5	47.3	26.9		
ok J 2309	24.2	11.3	6.0	46.7	24.8		
J 2292	24.6	13.0	6.5	52.9	26.4		
H J 2306	24.3	11.1	6.5	45.4	26.7		

Length
28.6 - 23.0 = 5.6
Prox
15.4 - 11.1 = 4.3
Dist.
8.2 - 5.9 = 2.3
ba
54.0 - 45.4 = 8.6
ca
29.8 - 24.2 = 5.6
da -
27.6 - 24.4 = 3.2

D. B. Spiz.

	a Length	b Prox.	c Dist.	ba	ca	d Br. shaft	da
D6993	32.1	12.4	7.1	√38.6	22.1	5.6	17.4
J2058	31.8	13.2	7.4	41.5	23.2	6.1	19.1
J2014	32.7	13.6	7.8	41.6	23.8		
C9348	33.5	14.2	8.1	42.4	24.1		
J2402	36.8	15.1	8.6	41.1	23.3		
C8055	37.0	14.7	9.1	√39.7	24.5		
J2051	37.3	15.5	8.4	41.6	22.5	6.8	18.2
B9121	37.4	15.5	8.8	41.4	23.4		
D4190	36.4	14.2	9.4	√39.1	25.8		
C8081	36.1	14.6	8.6	40.5	23.8	6.8	18.7
J1999	38.6	15.3	8.5	√39.8	22.0	7.0	18.1
B5682	38.6	15.3	8.7	√39.8	24.7		
J2050	36.0	15.3	8.9	42.5			
J2396	36.8	15.1	9.1	41.0			
C2458	37.6	15.1	9.1	40.2			
J2078	37.0	14.8	8.8	40.0			
J1996	38.0	15.2	8.7	40.0			
J1997	40.5	15.9	8.8	√39.3			
D4172	37.4	14.9	8.7	√39.8			
D3968	34.0	13.3	7.4	√39.1	21.7	6.0	17.6
? J2320	33.3	14.6	8.0	43.8			
J1989	32.9	13.2	7.4	40.1	22.5	5.9	17.9
J2059	33.2	13.5	7.6	40.7			
D1529	33.0	13.4	7.7	40.6			
D3738	34.6	14.1	7.9	40.8	22.8	6.2	17.9
J2331	33.3	13.8	7.7	41.4			
J2081	37.9	15.9	9.3	42.0	24.5	7.7	20.3
J1998	38.6	15.5	9.1	40.2	23.5	7.3	18.9

Length 40.5 – 31.8 = 8.7
Prox. 15.9 – 12.4 = 3.5
Dist. 9.3 – 7.1 = 2.2
ba 42.5 – 38.6 = 3.9
ca 24.5 – 21.7 = 2.8
da 20.3 – 17.4 = 2.9

2
2
3/4
6
94/4
105

Dnosphaenus?

	Length	Prox	D. P. Dist	Br. Shaft	Ba	ca	da
C9503	40.7	18.5	10.4	9.4	45..5	25.8	22.5
D2502	41.1	19.3	11.1	9.3	47.0	27.0	22.6
J1995	41.0	18.6	11.2	9.7	45.4	27.3	23.6
J6795	41.5	18.1	10.3	9.1	43.5	24.8	21.9
C7117	39.3	18.2	10.4	8.8	46.4	26.5	22.3
D6838	38.6	18.2	10.6	9.6	47.2	27.4	24.8
C6910	38.5	17.5	10.2	8.5	45.5	26.5	22.0
J2073	39.1	18.1	10.4	9.1	46.3	26.6	23.2
J2075	37.6	17.1	9.7	8.5	45.5.	25.7	22.5
J2083	36.2	16.6	9.3	7.7	45.8	25.9	21.2
J2074	36.5	17.0	9.8	8.5	46.5	26.8	23.2
D715	36.0	16.5	9.1	7.9	45.9	25.2	21.9
C6945	35.8	15.7	9.1	8.0	42.6	25.4	23.3
D1571	35.2	16.3	8.7	7.8	46.3	24.7	21.1
D6726	36.0	16.7	9.2	7.7	46.4	25.5	21.3
D2210	35.1	16.0	8.7	7.1	45.6	24.8	20.2
D2873	35.8	16.4	9.1	8.2	45.9	25.4	22.8
C 56.9	35.5	16.2	8.8	7.8	45.6	24.8	21.9

Length 41.5 — 35.1 = 5.4
Prox. 19.3 - 15.7 = 3.6
Dist. 11.2 - 8.7 = 2.5
Ba 47.2 - 43.5 = 5.7
ca 27.3 - 24.8 = 2.5
da 24.8 - 20.2 = 4.6

D I P1 neogyps?

	a Length	b Prox.	c Dist	ba	ca	
D6841	32.6	15.9	8.4	48.8	25.7	
J 2427	33.2	17.0	8.3	51.3	25.0	
C 1762	31.5	14.8	8.2	47.0	25.5	
J 2420	33.2	17.0	8.4	51.3	25.2	
B 3173	30.6	15.5	8.0	50.7	26.1	
× J 2060	31.0	14.7	7.0	47.5	22.5	– 6.7 – 21.8
C 836	31.9	15.6	8.6	48.9	26.9	
J 2012	32.0 –	15.7	8.5	49.1	26.5	
C 7116	32.2	15.8	8.8	49.1	27.3	-8.0 24.8
J 2085	31.8	16.0	8.8	50.5	– 27.8	
J 2411	34.2	16.1	8.7	47.1	– 25.4	
J 2061	30.6	15.0	8.4	49.0	– 27.4	
D 2677	30.6					
J 2172	32.1					
C 1725	32.8					
J 2140	31.5					
D 4583	32.0					
D 6795	32.6					
C 2358	34.8	16.9	8.8	48.6	25.2	
J 2063	29.8	14.7	7.8	49.4	– 26.1	
J 2065	30.9	14.0	7.4	45.4	23.9	
J 2256	30.7	14.9	7.6	48.7	24.7	

34.8 – 29.8 = 5.0

17.0 – 14.0 = 3.0

D3 P1

Morphnus	a Length	b Prox.	a Dist.	ba	ca	cb
J3258	30.9	12.0	7.3	38.8	23.6	60.7
J3259	32.9	13.2	8.6	40.2	26.1	65.1
J3264	32.8	12.4	7.8	37.8	23.7	62.9
E8099	29.4	11.6	7.0	39.9	23.7	60.3
C3883	31.0	12.4	7.6	39.5	24.5	61.3
Wet morphs?						
D 415	26.7	11.0	6.9	41.7	25.9	62.6
Urubit.						
062-?	22.1	9.6	4.9	43.4	22.1	51.0
J3275	22.7	9.8	5.4	43.2	23.8	55.6
J3274	22.3	9.5	5.9	42.6	26.4	62.1
J1977	21.7	8.4	4.9	38.7	22.5	58.4
J1973	20.8	8.4	5.1	40.3	24.5	60.7
D4243	22.7	9.7	5.7	43.3	25.6	58.7
J3273	23.1	9.3	5.2	40.3	22.5	55.9
J3271	22.7	9.7	5.7	42.7	25.1	58.7
J3276	21.7	9.2	5.3	42.4	24.4	57.6
J1972	21.0	8.4	4.8	39.9	22.8	57.2
J1939	21.6	9.0	5.2	41.6	24.0	57.7
C7435	22.2	8.7	4.8?	39.1	21.6	55.2
C4907	21.9	8.7	5.5	39.7	25.1	63.3
J1919	21.8	9.1	5.2	41.7	23.8	57.1
C5145	22.5	9.3	5.5	41.3	24.4	59.2
J1976	21.0	7.8	4.9	37.1	23.3	62.8
J3272	22.5	9.6	5.5	43.1	24.4	57.3
C5127	22.0	9.3	5.5	42.3	24.9	59.2
J1978	21.2	7.9	5.0	37.2	23.6	63.4

40.3
38.1
2.2

40.2
37.8
2.4

43.4 43.4
37.1 38.7
6.3 4.7

65.1
60.7
4.4

25.1
21.6
3.5

63.4
51.0
12.4

too variable

41.2
28.7

8.4 — 9.8 = 1.4
4.8 - 5.9 = 1.1

D3 P1

Spiz.

	a Length	b Prot	c Dist.		Ca		ca		cb
J 1722	24.5^{8}	9.6	6.3	—	39.3	—	25.7	—	65.6
J 1938	24.4^{8}	8.3	5.3	—	34.0	—	21.7	—	63.9
J 3406	24.6^{9}	8.7	5.6	—	35.3	—	22.7	—	64.4
J 3508	24.4^{6}	9.7	6.3	—	39.7	—	25.8	—	64.9
J 3558	24.8 (25.7)	9.9	6.4	—	39.9	—	25.8	—	64.6
J 1716	26.1^{3}	9.4.	6.4	—	36.0	—	24.5	—	68.0
J 3408	26.6	10.2	6.8	—	39.2	—	26.1	—	66.6
J 3400	26.7	10.3	7.0	—	38.6	—	26.2	—	68.0
J 3411	26.8	10.2	6.7	—	38.1	—	25.0	—	65.6
C 9413	26.3	10.9	7.1	—	41.5	—	27.0	—	65.1
J 3402	26.8	10.5	6.9	—	39.2	—	25.7	—	65.6
J 3542	26.4	10.6	6.8	—	40.2	—	25.7	—	64.1
J 3491	25.3	10.5	7.1	—	41.6	—	28.0	—	67.6
J 3403	26.7	10.0	6.8	—	37.5	—	25.4	—	68.0
J 3409	26.8	10.3	6.9	—	38.4	—	25.7	—	67.0
J 3399	27.3	10.7	6.8	—	39.2	—	24.9	—	63.6
J 3429	27.0	10.2	7.1	—	37.8	—	26.7	—	69.6
J 3392	27.1	10.6	6.8	—	37.7	—	25.1	—	64.2
D 3294	26.7	10.7	7.2	—	38.6	—	26.9	—	67.2
J 3404	26.6	9.9	6.5	—	37.2	—	24.4	—	65.7
J 3395	27.9	10.4	6.7	—	37.3	—	24.0	—	64.4
J 3338	27.1	10.0	7.1	—	36.9	—	25.2	—	71.0
J 3401	26.4	10.5	6.8	—	38.3	—	25.7	—	65.7
E 5736	27.1	10.7	6.9	—	39.5	—	25.4	—	64.5
J 3405	27.3	10.5	7.0	—	38.5	—	25.6	—	66.6
E 8543	27.7	10.8	7.0 a	—	39.1	—	25.2	—	64.8

Too variable

41.6
34.0
7.6

416
380
3.6

280
212
6.3

280
240
40

71.0
63.6
7.4

83
73
1

10.9
9.8
1.1

8.3 — 10.9 = 2.6

9.4. — 10.9 = 1.5

5.3 — 7.2 = 1.9

D3P1

neogyps?

	a Length	b Prox.	c Dist	Ba	ca
D962	28.3	11.8	7.2	41.7	25.4
J3316	27.3	11.2	6.2	39.6	22.7
J3266	27.3	11.4	6.3	41.7	23.0
J3315	27.2	12.0	6.7	43.8	24.6
J3290	26.4	11.2	7.0	41.8	26.5
J3321	27.7	11.5	7.1	41.6	25.6
J3544	26.7	11.3	6.4	42.4	24.7
J3326	27.3	11.8	7.3	43.3	26.7
J3308	26.8	11.2	6.4	41.8	23.8
J3269	26.7	10.5	6.4	39.3	23.9
J3291	26.8	11.3	6.8?,	42.2	25.3
D959	27.1	11.3	6.6	41.7	24.3
J3547	26.9	10.7	6.5	39.8	24.1
B5786	26.5	11.0	7.0	41.6	26.4
D4360	26.4	11.2	6.8	42.4	25.7
D4469	26.3	11.7	6.9	44.5	26.2
J3539	26.1	10.7	6.6	41.1	25.2
J3538.	25.8	10.7	6.4	41.5	24.8
D4225	26.2	11.3	6.8	43.2	25.9
J3294	26.4	11.1	6.8	42.1	25.7
J3305	25.4	10.2	6.8	39.8	26.7
C 279	26.4	11.2	6.9	42.1	26.1
J3300	27.0	11.7	6.5	43.4	24.0
C7433	25.9	11.1	6.6	42.8	25.4
J3288	26.1	11.3	6.9	43.3	26.4
J3263	26.1	10.8	6.4	41.4	24.5
J3307	26.0	11.2	6.8	43.1	25.1
J3304	25.4	11.0	6.3	43.3	24.4
J1698	25.3	10.6	6.7	41.9	26.4
J3531	25.0	10.4	5.7	41.6	22.8
J3481	24.9	10.7	6.3	43.0	25.3
D7057	24.9	10.9	6.1	44.0	24.5

24.9 — 28.3

10,2 — 11,8 = 1,6

5.7 — 7,3 = 1,6

10,2	11.8
9,0	9.6
1,2	2.2

D3P, Aquila

44.5
38.3
6.2

	a Length	b Prox.	c Dist.	ba	ca
J 3372	26.7	11.0	7.2	42.8	26.9
J 3348	27.0	11.6	7.4	43.0	27.4
J 3467	25.2	10.4	7.0	41.3	27.7
J 3360	27.2	11.6	7.7	42.7	28.2
F 5742	25.8	10.0	7.3	38.8	28.2
J 3344	26.9	11.0	7.4	40.9	27.5
J 3357	26.7	11.6	8.0	43.4	29.9
J 3578	24.9	10.3	6.8	41.4	27.3
J 3571	25.5	11.2	7.4	43.9	29.0
D 96	26.1	10.0	7.0	38.3	26:8
J 3364	28.3	11.8	8.5	41.7	30.0
J 3563	25.5	10.9	6.8	42.8	26.6
J 3355	27.2	11.2	7.7	40.8	28.3
J 3574	25.7	10.3	7.3	40.1	28.4
C 1635	27.0	10.4	7.2	38.5	26.6
J 3358	26.7	11.5	7.6	43.1	28.5
D 77	26.8	11.1	7.3	41.2	27.2
C 5040	24.9	10.2	6.4	41.1	25.7
C 232	26.8	11.0	7.2	41.1	26.8
J 3556	26.0	10.1	6.8?	38.9	26.1
C 1640	26.7	11.3	7.5	41.7	28.1
D 91	26.1	11.6	7.3	44.5	27.9
J 3566	25.1	10.1	6.5	40.3	25.8
J 3485	24.9	9.8	6.7	39.3	26.9
D 3295	24.9	9.9	6.2	39.7	24.9
J 3440	26.2	10.7	7.4	40.8	28.2

9.8 – 11.6 = 1.8

6.2 – 8.5 = 2.3

9.8
8.8
1.0

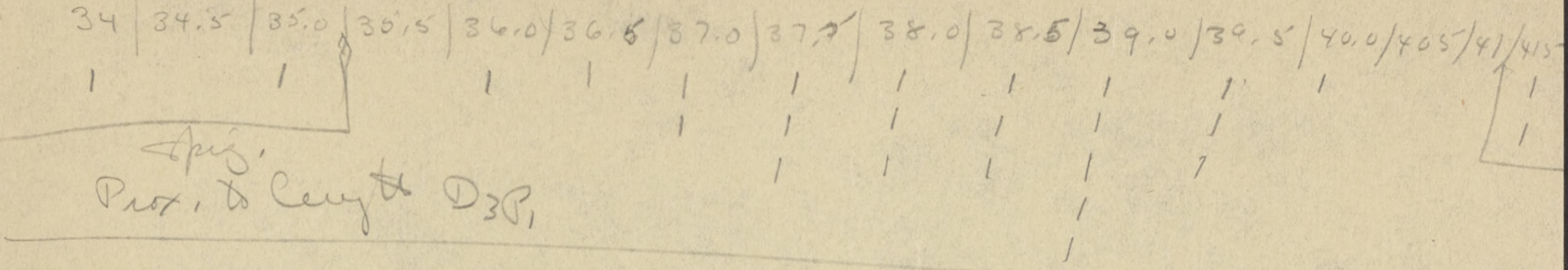
11.6
11.4
.2

38	38,5	39	39,5	40	40,5	41	41,5	42	42,5	43	43,5	44	44,5
/	/ / /	/	/	/ /	/ / /	/ / / / /	/ /		/ / /	/ / /	/		/

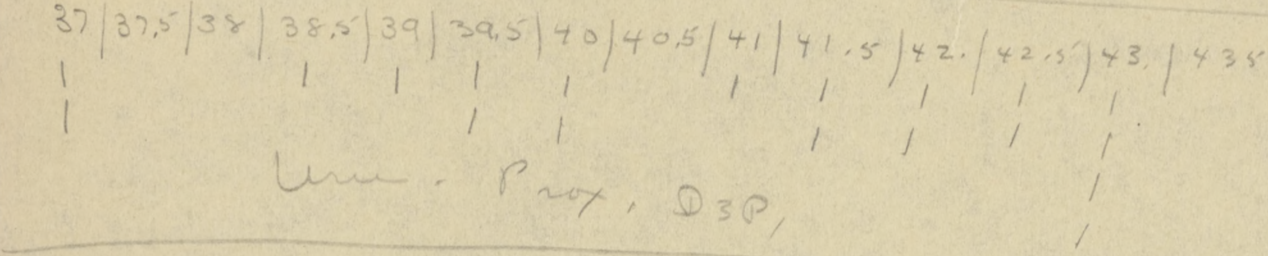
Aquila D3P, Prox.

24,5	25.	25,5	26	26,5	27	27,5	28	28,5	29	29,5	30
/		/ /	/	/ / / / / /	/ / /	/ / /	/ / / / / /	/	/	/	/

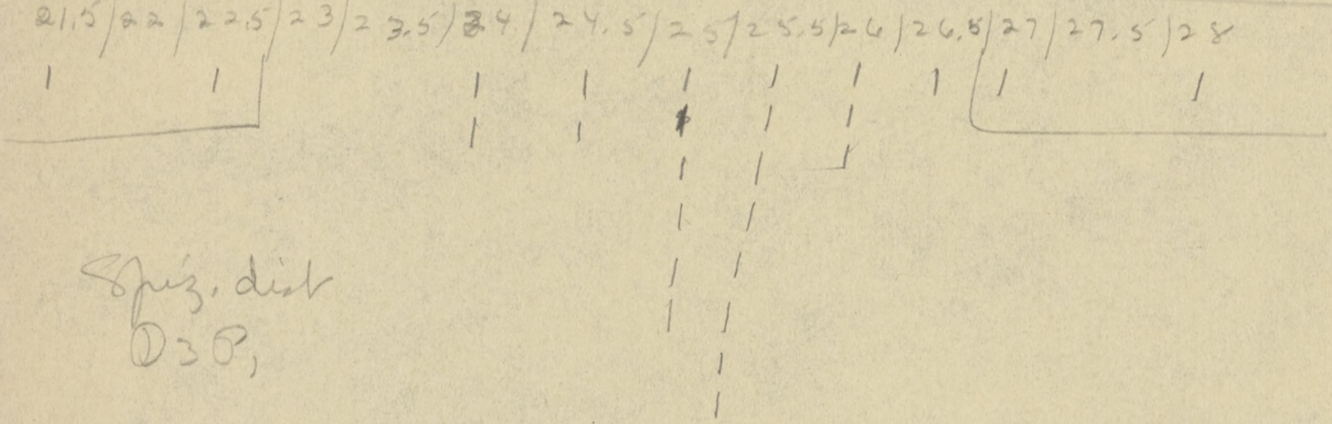
Aquila D3P, Dist.



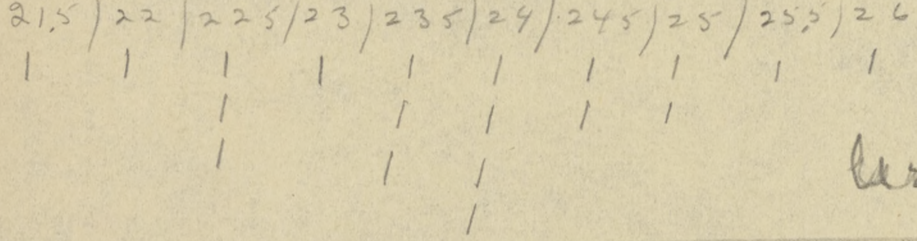
Spiz.
Prox. to Length D_3P_1



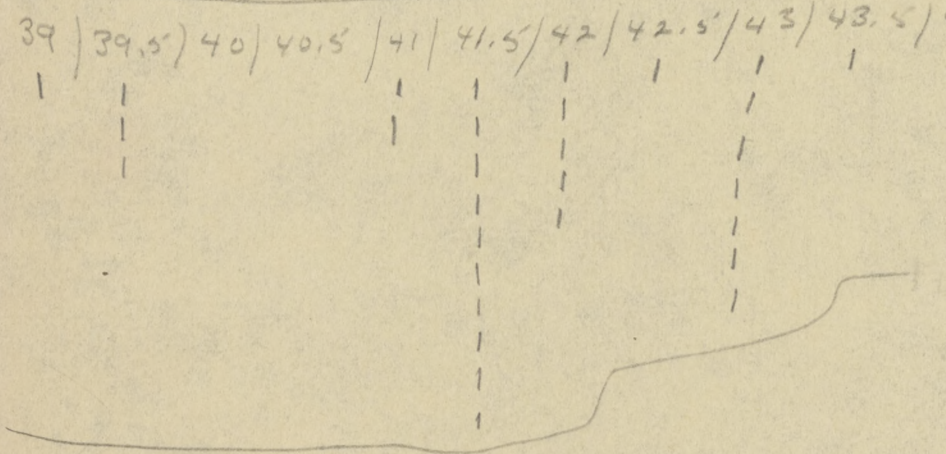
Uru. Prox. D_3P_1



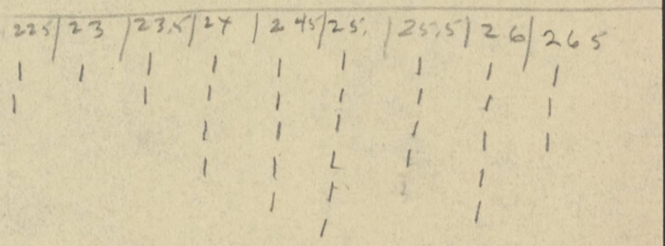
Spiz. dist
D_3P_1



Uru. dist D_3P_1



Neog.? Prox D_3P_1



Neog. dist.
D_3P_1

	Dist. tar	Br. D3P1 Prox	
Hal	26.7 −	14.3	= 53.6%
232)	23.6 −	11.5	= 48.7%
Oto	23.7 −	10.6	= 44.7
Gen	22.4 −	10.6	= 47.4
N−	21.4 −	10.2	− 47.6
N+	24.0 −	11.8	− 49.1
Ag−	21.8 −	9.8	− 44.9
Ag+	22.3 −	11.6	− 46.1
S.−	18.4 −	8.3	− 45.1
S+	23.8	10.9	− 45.8
M−	24.3 −	11.6	− 47.7
M+	28.4	13.2	− 46.2

	Length tar.	Length D3P1	D3P1 %	D1P1	D3P1 %	D1P1 %	Br. Dist tar
Oto	95.5	38.0	39.9			60.8	23.7
Nep.	81.3	24.1	29.6	22.8	72.8	69.8	16.8
232	104.4	34.1	31.4	30.0	78.7	69.3	23.6
Gyp	99.5	33.8	34.0			73.0	24.9
Hal	97.6	30.0	30.7			89.0	26.7
Gen	114.4	26.1	18.2	30.2	73.7	87.9	22.4
N−	84.0	24.9	29.6	23.0	93.1	86.1	21.4
N+	93.0	28.3	30.4	27.7	87.1	85.3	24.1
S−	100.6	24.4	23.0			74.7	18.4
S+	114.8	27.9	19.3			82.4	23.0
M−	127.1	29.4	10.8			82.6	24.3
M+	136.7	32.9	8.9			86.4	28.4
Aept.−	85.8						14.7
	97.2						16.1

Pedal phalanx DI P1

	Spiz.	Wet.	Morph.	Urm.	Neog.
Length	40.5 31.8	29.3	41.5 35.1	28.6 23.0	34.8 29.8
Prox.	15.9 12.4	14.2	19.3 15.7	15.4 11.1	17.0 14.0
Dist.	9.3 7.1	6.9	11.2 8.7	8.2 5.9	8.8 7.0
Ca	42.5 38.6	48.5	47.2 43.5	54.0 45.4	49.4 45.4
ca	24.5 21.7	23.5	27.3 24.8	29.8 27.2	27.8 22.5
da	20.3 17.4	22.4	24.8 20.2	27.6 24.4	24.8 21.8

Length Morph - Spiz.; Neog. - Wet.?;
Prox. Neog. - Wet?; Urm includes Wet.;
Dist. " " ?; " " ";
Ca Neog includes Wet.; -
ca " " " Urm includes Morph.
da " " "

Tarsus - Aquila

U.C = Univ. Calif. Coll.

a Greatest length	b Breadth prox end	c Dist point of to muscle scar to proc R
98.4	21.6	19.3 — 19.6%
100.3	20.7	19.4 - 19.3%
97.3	19.5	20.0
96.7	20.7	20.8
99.1	20.8	20.3
97.3	21.2	21.4
98.6	22.3	20.7 (a)
102.9	21.9	21.9
94.7	22.4	21.3
99.4	23.6	21.3
98.3	20.7	21.4
100.8	23.1	26.8
97.6	21.2	21.9
108.7	22.4	23.2
98.7	21.3 (a)	20.0
93.4	21.3	20.7
106.1	23.2	24.5
98.7	20.6	21.8
101.2	23.1	24.5
102.2	21.3 (a)	21.7
98.7	22.5	21.3
100.3	23.4	23.0
95.0	20.6	21.5
97.3	20.7	21.5
96.3	21.3	20.8
102.3	22.4	23.5
100.2	22.4	23.6
101.2	22.7	22.0
101.8	21.6	21.2
98.2	21.6	21.0
98.3	22.1	21.1
99.9	21.2	21.6
95.2	19.9	19.7
☆ 100.0	23.1	22.9
99.1	22.6	24.3

Greatest length	Breadth ~~prox~~ end	Dist from prox end to of muscle scar
100.2	20.3	19.5
102.1	23.1	22.6
96.9	22.4	20.9
97.3	20.9	19.6
99.8	22.4	22.0
102.0	21.5	21.8
98.2	22.0	21.0
103.2	22.2	23.0
93.3	21.4	20.5
96.3	22.3	22.6
109.2	24.1	25.5
99.8	22.6	22.3
100.0	~~21.2~~	~~21.0~~
~~94.4~~		
94.8	21.9	21.6
95.0	22.6	21.5
98.0	20.6	20.4
97.4	21.3	20.5
100.7	20.5	20.0
97.1	21.0	21.7
[illegible] (92)	19.9 ~~20.0~~	21.5
91.4	20.2	21.0
101.6	25.1	23.6
96.7	20.5	21.2
99.7	20.3	19.6
98.0	21.4 ~~21.6~~	20.1
93.6	20.0	19.7
99.2	20.2	22.2

1087
103.2

Eagle Tarsus Breadth of proximal end.

Aquila: —

20.7 mm
20.7
19.6
~~19.9~~
21.2

Femur Aquila ul

	Gr. length	dist. end	prox. end	head depth	head ht.
1)	126.8	26.7	28.5	11.0	11.2
2)	126.3	26.5	28.3	11.0	11.0
3)	125.5	24.8	26.5	10.5 a	10.6 a
4)	✓ 125.5 a	27.4	29.5	11.3	10.7
5)	129.7	28.6	30.1	11.5	11.5
6)	126.0	27.0	29.5	11.8	11.8
7)	127.4	27.7	29.3	11.2	11.3
8)	128.2	28.2	29.1	11.3 or 4	11.3
9)	127.2 (toward side) do.	28.4	29.6	11.7	11.7
10)	132.9	29.5	30.8	11.7	11.7
11)	129.3	26.8	27.8	11.0	11.0
12)	✓ 124.7	24.8	25.7	10.6	10.3
13)	124.3	25.3	26.3	10.7	10.5
14)	✓ 125.3	27.6	27.8	11.3	11.0
15)	130.8	28.4	30.1	11.9	12.1
16)	126.2	27.0	28.2	11.1	11.1
17)	121.6	25.9	26.9	10.6	10.6
18)	128.5 a	28.4	29.8	11.8	11.9
19)	125.8	27.0	28.5	11.1	11.1
20)	131.5	28.5	29.3	11.5	11.6
21)	124.2	25.5	27.2	10.4	10.7
22)	124.3	24.4 a	26.6	10.6	10.7
23)	131.0	27.8	29.4	12.2	12.2
24)					
25)					

may be a fraction of mm below depth each time

Tibia Aquila

U.C

Prox. art surf.	Br. dist. end	
	ant.	post.
22.2	22.1	21.6
20.3	19.4	19.5
22.7	21.9	21.6
21.6 a	20.7	20.3
22.6	21.7	21.6
19.7 a	19.3	19.0
24.0	23.1	22.5
22.7	22.0	21.9
22.4	21.9	21.1
20.2	20.1	19.8
21.2	20.4	20.0
22.8 a	23.6	23.4
22.3	21.8	21.4
22.3	21.8	21.6

Geranoaetus fragilis – tarsus

U.C.

a Greatest Length	b Breadth of dist end	c Dist from prox end to top of muscle scar	Ratio of a to c
99.3	15.4 ✓	13.5	
106.3	17.0 ✓	14.3	
96.1	15.3 ✓	12.4	
108.5	17.8 ✓	14.7	
103.7	15.7(a)	12.4	
99.2	15.5 ✓	13.4	
96.6(a)	16.6 ✓	13.2	13.6
108.9	17.4 ✓	14.4	
101.8	16.6 ✓	12.4	
102.2	15.3(a)	13.4	
99.2	15.5 ✓	12.1	
105.8	18.0(a) ✓	13.5	
100.4(a)	17.4 ✓	13.0	
102.2(a)	16.2 ✓	12.2	
	17.2 ✓	14.0	
	15.3 ✓	14.3	
	~~14.4~~	~~13.3~~	

U.C.

Eagle tarsus *Geranoaetus grinnelli*

a Greatest Length	b Breadth prox. end	c Dist. from prox. end to top of muscle scar	Ratio of a to c
110.8 mm	19.2✓	20.3 mm	18.3
109.4	20.7✓	19.8	18.1
108.2	19.7✓	19.6	18.1
107.6	19.8✓	19.2	17.8
105.5′	19.7✓	19.8	18.8
110.7	20.6✓	20.5′	18.5′
102.5	19.5✓	18.2	17.7
108.7	19.7✓	19.5′	17.9
112.0	19.0(a)	20.2	18.0
107.0	18.6✓	19.0	17.7
103.3	~~20.3~~ ~~19.4~~ (20.3)	19.4	18.7
108.3	19.5✓	18.1	16.7✓
108.2	19.4(a)	19.3	17.8
107.6	18.6(a)	19.4′	18.0
102.1	19.2(a)	18.0(a)	17.1

☆ A projection at the post. edge of the outer side is very prominent, thus giving the extra breadth. (This projection may or may not be worn in other specimens)

[illegible]

Prox. end
σ = .717+

19.700
.717
20.417

19.700
.717
18.983

$161^{8}1^{9}$

11)21731
19.71

11)2173(41
22
16

11)2173(19.75′
11
107
99
83
77
60

Tarsus | Neogyps errans Tibia U.C

Greatest Length	Breadth of prox. end	Dist. from prox end to top of innr. scar.
85.8	21.6 ✓	16.8
88.5	20.8 ✓	18.1
88.0	21.6 ✓	18.2
93.3	22.3(a)	18.2
97.0	21.8 ✓	18.1
84.7	21.1 ✓	17.0
92.8	20.7 ✓	18.8
88.6	21.3 ✓	18.8
88.7	20.7 ✓	16.6
93.8	22.3	18.8
88.1	21.4 ✓	17.0
86.1	19.0 ✓	17.3
87.0	19.0 ✓	16.8
82.3	20.1 ✓	16.9
89.1	19.8 ✓	17.0
	21.0 ✓	18.8
88.6	19.6 ✓	17.4
85.3	20.4(a)	16.6

Breadth art. surf. prox. end
18.8
18.9a
18.8

Breadth dist. end ant.	Breadth dist. end post.
19.0	18.9
18.6	18.5
18.6	18.2
18.0(a)	17.7(a)
19.3	18.9
18.5(a)	18.0

Tibia G. grinnelli UC.

dist. end post.
σ = .993

Ant. surf. of prox. end, breadth	Breadth of dist. end Post. meas.	Bdth dist end Ant. meas.
19.6 a	19.3	18.9
18.9	18.7	18.6
16.6 a	16.3	16.2
19.3 a		
19.8		
Total 5)94.2(1 18.84	18.5	18.5
	17.8	17.7
	18.3	18.3
	18.9	18.5
	18.6	18.6
	19.6	19.4
Total	8)146.4 18.3 9)166.0 18.44	8)145.3 18.1625 9)164.7 18.3

Femur

* Wets ——— ?

Morphnus ——— large ——— Buteonine - G. fragilis

G. fragilis ——— ~~[illegible]~~ ——— " - [illegible] woodwardi

G. grinnelli ——— medium ——— Aquilinae -

Neogyps — small & heavy ——— Haliaeetus - Vulturidae

Neophrontops — small ——— Neophron

+ Pelvis ———

"

large ——— Buteonine

medium with ——— "

medium ——— Spizaetus

large ——— Vulturidae

small ——— Neophron

X Sternum -

large — Buteonine

medium — "

medium — Spizaetus

large — Vulturidae

small — Neophron

Furcula

large — Buteonine

small — "

small — Spizaetus

large — Hal & Vult,

small — Neophron

Coracoid

large — Buteonine

small — "

small — Aquilinae

large — Vulturidae

small —

*

write up.

2^{4}_{34} $^{19}_{14}$

Ulna
1
2 large — Buteoninae ——— 8
3 medium — Buteoninae —— 25
7 medium — Aquilinae ——— 23
5 large — Vulturidae ——— 60
6 small — Neophron ——— 84

Radius
large — Buteoninae ? ? 11
medium ~~Buteoninae ?~~ 15
medium — Aquilinae — 33
large ——— 21
small Neophron 33

Carpometacarpus
large —— 11 Geranoaetus or pag
medium —— 36 Geranoaetus or wood.
medium ——— ~~5~~4 larger Aquilinae than Buteoninae
large —— 63
small Neophron 145

Cranium ——— 3
large
medium Buteoninae —— 7
medium Aquilinae — 9
large 19
small x ——— 6

Rostrum
large ——— 3
medium ——— 6
medium ——— 3
large
small ——— 6

Mandible
large ——— 1
medium ——— 5
medium ——— 3
large ——— 2

draughth

Pelvis, continued

W. daggetti			
M. woodwardi	Buteoninae	Large	4
G. fragilis	Buteoninae	Medium	6
G. grinnelli	Spizaetus	Medium	8
Neogyps errans	near Vulturidae	Large	5
Neophrontops americanus	Neophron	Small	26

With the size of the pelvis of ~~G.~~ fragilis, grinnelli & Neogyps decided upon the sternum was less difficult to identify since pelvis & sternum ~~agreed~~ [illegible] in size. As with the pelvis, the characters also correspond.

Sternum

W. daggetti			
M. woodwardi	Buteoninae	Large	2
G. fragilis	Buteoninae	Medium	11 11
G. grinnelli	Spizaetus	Medium	12
Neogyps errans	Vulturidae	Large	17
Neophrontops americanus	Neophron	Small	42

The furcula & coracoid presented no outstanding difficulties, in view of their agreement with the tarsus in the matter of ~~[illegible]~~ similarity with living forms.

Furcula

W. daggetti	~~xxxxxxxxxx~~		
M. woodwardi	Buteoninae	Large	6
G. fragilis	Buteoninae	Medium	13
G. grinnelli	Spizaetus	Medium	17
Neogyps errans	Haliaeetus, Vulturidae	Large	25
Neophrontops americanus	Neophron	Small	33

Coracoid

W. daggetti			
M. woodwwrdi	Buteoninae	Large	12
G. fragilis	Buteoninae	Medium ~~small~~	58
G. grinnelli	Spizaetus	Medium	58
Neogyps errans	Vulturidae	Large	37
Neophrontops	Neophron	Small	172

Tibiotarsus .--

W. daggetti	very long, slender
M. woodwardi	long, slender
G. fragilis	shorter, slender
G. grinnelli	
Neogyps errans	
Neophrontops americanus	

addit. records of fossil eagles cont'd.

Up. Mio Snake Creek
Aquila sp. (Wetmore 1923)
G. contortus Wet. (1923)
Early mid Mio. - Lower Sheep Creek (same loc. as G. cont. but lower bed
Urubitinga erecta Wet. (1923)
Low. Plio (upper Snake Creek (same locality as G. contortus but higher beds
G. conterminus Wet. (1923)
Miocene (Lower Harrison beds)
G. ales Wet. (1924)
Miocene (Loup Fork)
G. dananus (Marsh) 1871 & 1924

Aquila chrysaetos
RLB, ~~[illegible]~~ calif. McK; Fossil Lake, Oregon.
Aquila pliogryps Shufeldt
Fossil lake, Oreg.
Aquila sodalis, Shufeldt

Geranoaetus melanoleucus?
Hawver cave, Calif.
Geranoaetus fragilis Miller
RLB, Carp.
Geranoaetus grinnelli
RLB, Carp.
Haliaeetus leucocephalus
RLB, Fossil Lake
M. woodwardi -
RLB
Met. dagg~~ett~~i
RLB & Carp

The two species of old world vultures are known also from Carp. & Neophrontops from McK as well.

Buteo

	331 borealis
Tarsus	85.1
Femur	82.6
Tibia	110.0
	277.7
Carpus	61.9
Humerus	108.8
Ulna	128.1
	298.8
leg to wing	93.3 %
Coracoid	42.0
cor. to wing	14.0 %
" " leg	15.1 %
hum to ulna	84.9
fem to hum	75.9

77
110.0) 8510
7700
8100
7700
4060

97
851) 8260
7659
6010
5957
0530

75
110) 8260
7700
5600

Buteo

23	22	21	20	19	18	17	16
23.7	22.0	21.3		19.3	18.5	17.9	16.3
	22.5	21.3		19.0	18.4	17.3	16.4
		21.8			18.0	17.1	16.7
		21.5			18.7	17.4	
					18.2	17.3	
					18.2	17.9	
					18.2	17.8	
					18.7	17.5	
					18.3	17.3	
					18.0	17.7	
					18.1		
					18.1		
					18.7		
					18.1		
					18.2		
					18.5		

scapula

23.5	23.0	22.5	22.0	21.5	21.0	20.5	19.5	19.0	18.5	18.0	17.5	17.0	16.5	16.0
23.7		22.5	22.0	21.8	21.3			19.3	18.5	18.2	17.9	17.3	16.7	16.3
				21.5	21.3			19.0	18.7	18.1	17.9	17.1		16.4
									18.7	18.1	17.8	17.4		
									18.7	18.1	17.5	17.3		
									18.5	18.0	17.7	17.3		
										18.3				
			38	7	7-38—					18.2				
										18.2				
										18.2				
										18.0				
										18.4				
1		.1	1	2	2			2	5	11	5	5	1	2

Lines correct no. rod.

	Ratio Carpus to Humerus	Tarsus to Femur	~~[illegible]~~ to Humerus	Tarsus to Carpus
Neogyps	49.9 51.3%	81.3% 82.0%	50.9 52.1	83.0 84.0
Otogyps	50.6	84.8	53.0	88.7
Neophron	53.2	114.8 ✓	48.5 ✓	104.7 ✓
"sp. ?"	61.4 ✓	103.9 ✓	52.2	88.3
Gypaetus	43.9 ✓	79.4	51.7	93.6
Haliaeetus	52.8	77.3	55.6	81.5
Aquila	53.2	75.7	67.9	96.6
Geranoaetus	54.7	101.0	69.9	130.0
Grin. pect. & Neogyps pelvis	50.9 55.3		72.7 65.3	116.1 97.0
G. pag			60.2 61.7	
Morphnus			61.8 or 64.8	
g. grin,				
G. grin,			69.4	
Neogyps pect. g. grin pelvis			53.9 55.8	

87.4
262) 2290
2098
1940
1834
1060
848

88.4
190) 1680
1520
1600
1320
800
760
140

89.8
187) 1680
1496
1840
1683
1570

88.2
315) 2780
2520
2600
2520
800

88
315) 28000
2520
2800

89.6
261) 2340
2088
2520
2349
1710

897
292) 2620
2336
2840
2628
2120
2044

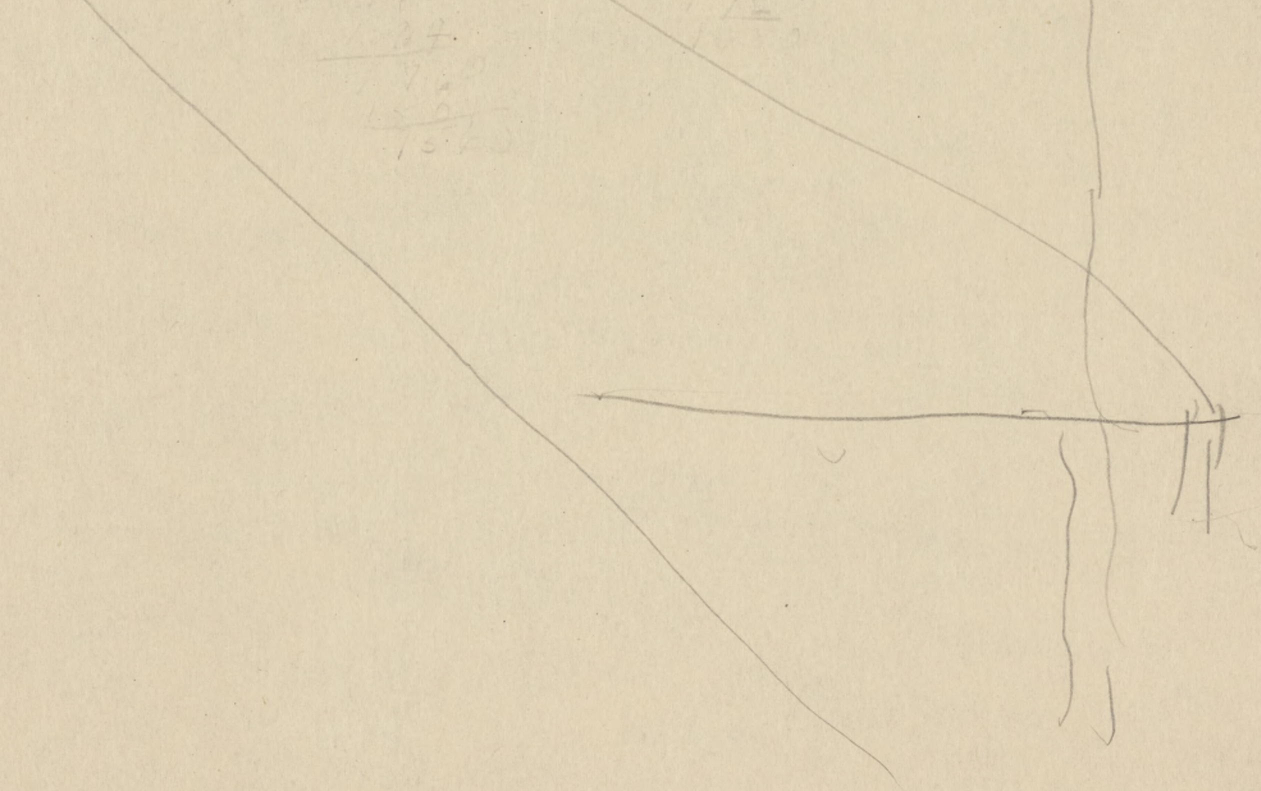
874
262) 22900
2096
1940
1834
1060
1048

87.3
230) 20100
1840
1700
1610
900
690
210

883
258) 2280
~~2064~~
2160
2064
960

88.4
278) 2460
2224
2360
2224
1360
1390

9
273) 2520
2487
3360



	Cran stern.	Cran Beak	Cran hum.	Cran femur	Fem Hum	Total differences		
Otogyps	100.7%	84.8%	24.3%	44.8%	53.1%	234.7	7	
Neophron	85.6%	108.6%	23.6%	62.8%	48.5%	222.7	6	
Vultur sp.?	78.4%	82.8%?	33.7%	64.6%	52.2%	130.0	2	✓
Gypaetus	102.4%	84.6%	29.1%	56.0%	51.8%	181.6	5	
Haliaeetus	68.9%	85.4%	29.7%	53.5%	55.6%	123.5	1	✓
Aquila	74.2%	61.0%	31.5%	48.2%	65.4%	150.6	4	
Geranoaetus	63.3%	67.9%	39.2%	56.1%	69.9%	146.1	3	
Neogyps	64.7%	72.5%	29.9%	66.4%	52.1%			
	65.7%	72.0%	28.0%	64.3%	51.1%			

	Neogyps	Pseudogyps	Neophron	sp.?	Gypaetus	Hal	Aq.	Ger
Cranium	66.5 a 75.4	51.7	44.5	67.4	70.4	67.4	63.6	62.8
Beak	35.0 37.0	42.4	40.1		47.3	41.6	30.7	28.6
Mandible	2.7 3.5	2.5	1.6	2.5	1.8	3.2	2.8	2.8
Sternum	43.7 48.0	52.1	38.1	52.9	72.1	46.5	47.2	39.8
?. Coracoid	65.9 69.9	77.8	52.4	73.9	88.7	75.2	72.1	61.2
?. Scapula	18.7 20.5		14.3	19.5	22.5	19.4	19.9	17.7
Humerus	202.8 215.4	212.4	145.7	199.8	241.9	226.4	194.0	159.9
Carpus	101.1 110.6	107.6	77.6	122.7	106.3	119.7	103.4	87.6
Femur	103.4 113.4	112.6	70.8	104.3	125.2	126.1	? 131.9	111.9
Tibia	140.9 153.6	158.9	116.9	159.4	170.9	166.0	163.4	153.4
Tarsus	84.0 93.0	95.5	81.3	108.4	99.5	97.6	99.9	114.1

	Neogyps	Neophron	Orogyps
Cranium	66.5 75.4		

69

tarsus

	a	b prox	c dist	d tub. [illegible]	~~x~~ Depth shaft	e		e	
Morphnus	103.7	16.3	18.6	18.5	10.4				
J 9861	104.0	15.8	18.2	17.7	8.1				
C 2019	109.7	18.3	19.8	18.5	9.4				
Geranoaetus	114.6	20.6	22.8	22.4	9.5'				✓
Aquila 679	101.0	21.1	23.4	29.4	10.4				✓
" 421	100.0	24.7	26.3	27.7	10.9				✓
D 4828	131.7	23.4	26.4	21.5'	11.1				
D 2417	130.3	22.6	25.1	22.5'	11.0				
D 1072	139.6	24.4	26.9	26.5'	11.6				
C 5920	106.7	19.4	22.3	24.1	10.6				[illegible]
C 2860	101.3			21.0	8.8				
D 5225'	108.6	19.6	21.9	25.8	10.5'				[illegible]
F 1903	99.8	15.5'	17.4	15.3	–				
Buteo 148	90.9	16.0	16.4	18.8	8.3				✓
Buteo 242	89.0	15.6	17.1	17.6	8.2				✓
C 6655'	107.5'	17.4	19.9	22.6	9.0				
D 149	106.8	15.8	18.4	16.8	8.2				
G 2841	108.2	18.2	20.7	18.9	9.3				
D 6976	108.6			25.4					
C 8786	111.7	21.8	23.7	26.0	11.1				
C 6859			22.3		8.5	12.6	13.0	38.1	
C 6804			22.3		8.7	11.9	13.0		
J 9857			20.0		7.5'	10.8	11.4	37.5	
D 6752			22.8		8.4	11.8	12.8	36.8	
Aq. 679			23.3		9.9 ✓	13.5	13.8		

	a	x	b	xa	ba	h	ha	i	j	ij
7 goo.	84.1	17.5	16.4	20.8	19.5	12.9	15.3%	13.7	14.5	94.4
738 um	88.5	17.3	16.4	19.5	18.5	13.1	14.8	12.5	15.0	83.3
245 Pb.	82.8	16.6	15.7	20.0	18.9	12.6	15.2	13.2	14.2	92.9
240 Rt	88.9	18.7	17.6	21.0	19.7	14.2	15.9	14.5	15.1	96.0%
222 Rt	83.5	18.5	17.7	22.1	21.1	13.9	16.6	14.9	16.1	92.5%
152 Rt	81.9	16.1	15.6	19.6	19.0	12.5	15.2	12.4	14.49	86.0
468 Rt	84.2	16.7	15.8	19.8	18.7	13.6	16.1	14.1	15.5	90.9
14 Ab	96.8	20.8	19.8	21.4	20.4	15.8	16.1	16.9	18.3	92.3%
233 g.	111.9	24.2	22.4	21.6	20.0	18.4	16.4%	18.9	20.3	93.1%
aguilar	125.3	30.0	28.4	23.9	22.6	24.0	19.1%	23.1	25.7	89.8
3 ,,	131.0	31.8	29.2	24.2	22.3	24.2	18.4%	23.2	26.3	88.2%
679 ,,	124.5	27.8	26.1	22.3	20.9	20.9	16.7%	20.9	22.7	92.0%
471 ,,	131.9	29.2	28.2	22.1	21.3	22.6	17.1%	22.4	24.2	92.5
151	126.3	29.9	28.5	23.6	22.5	23.4	~~18.6%~~	24.6	25.0	94.4
C6554	121.3	27.7	25.0	22.9	20.6	—	—			
D2183	117.6	26.4	24.8	22.4	21.0	20.6	17.5%	18.9	21.2	89.1
C9270	116.1	25.5	23.9	21.9	20.5	19.4	16.8%	19.0	21.5	88.3
C5688	121.3	27.0	24.6	22.2	20.2	21.2	17.4%	20.1	22.5	89.3
C1028	116.9	26.6	24.3	22.7	20.8	19.1	16.3%	19.4	21.6	89.8
C1111	130.7	28.6	26.8	21.8	20.5	21.5	16.4%	20.5	24.0	85.4%
D2487	124.6	27.0	25.3	22.4	20.3	21.7	17.3%	19.6	22.9	85.4%
F5437	97.8	19.9	18.1	20.3	18.5	14.7	15.0%	14.3	16.7	87.2
E3759	98.5	20.0	18.7	20.3	18.9	15.0	15.2%	14.0	16.9	82.8
E2626	99.0	20.7	19.0	20.8	19.1	15.8	15.9%	15.6	18.3	85.2
C5857	97.6	19.7 –	18.1 –	20.7 –	18.5 –	14.7	15.0% –	14.5	16.3	88.9
C8425	99.8	21.0	19.6	21.0	19.6	15.4	15.4%	15.3	17.5	87.4
D3433	103.6	21.6 –	20.2 –	20.9 –	19.5 –	17.0 –	16.4%	16.1	18.7	86.0%
	121.3									
F4382	116.0	25.8		22.2		19.8	17.0			
2355 2393	117.4	26.1		22.2		20.1	17.1		21.0	
C1241	117.3	26.7		22.7		19.4	16.5			
C1362	113.2	24.4		21.4		17.6	15.5	17.4	19.0	91.5

Hawks

Hawks

grinnelli of Ga. Gen.

ggg

woodwardi of Ga. Gen.

ag. g

Bakeri

[illegible]

Humerus

	a	b	c	d	e	h
Gyr. 237	160.2	62.2	28.8	32.2	18.8	32.2
Aquila 629	180.5	71.4	31.1	34.7	20.1	30.2
421		78.2	34.4	37.7	21.0	32.7
Hal 291	196.3	71.1	32.3	35.2	18.8	36.7
626	228.7	88.6	38.2	41.8	22.5	49.0
Arm 738	121.3	43.5	20.1	21.4	10.4	20.5
Buteo 427	101.0	39.2	18.0	19.7	10.6	17.9
307	120.4	46.0	19.1	21.9	12.6	21.6
240	118.8	46.8	20.3	23.0	12.6	21.8
331	108.9	43.8	18.5	20.9	11.6	20.0
222	113.3	43.7	20.4	23.3	12.0	20.1

Cranium								
Breadth	Neo ~~75.4~~ 71.0	Gyp. 70.0	Hal sp.? } 67.4	Neog. 66.5 ~~Aquila 63.0~~	Aq. 63.0	Ger. 62.8	Oto. 51.7	Neph. 44.5
Depth	Aq. 50.3	Gyp Oto } 50.0	sp.? 49.1	Hal. 48.7	Neo. } 47.7 47.7	Neo 45.4	Ger. 42.1	Neph. 36.9
Beak								
Length	Gyp. 47.3	Oto. 42.4	Hal. 41.6	sp.? 40.7	Neph. 40.1	Neo 36.3-35.0 Neo. 37.0	Aq. 30.7	Ger. 28.6
Height	Hal. 26.6	Neo - 22.3 ~~Oto~~ - 22.2	Neo-21.8-21.9	neo. 20.1 Oto 20.4	Aq. 19.9	Gyp. 19.6	Ger. 15.8	Neph. 13.9
Sternum	Gyp 72.1	sp.? 52.9	Oto. 52.1, ..	Neo. 48.8-48.0	Aq. 47.2	Neo. 46.4 Hal. 46.5	Neo. 45.0-43.7	Ger. 39.8 Neog. 38.1
Coracoid	Gyp. 89.1-88.3	Oto. 77.8	Hal. 75.2.	sp.? 74.1-73.8	Aq. 72.1	Neo. 64.4-65.9	Ger. 61.2	Neph 52.7-3
Scapula	Oto.? 22.2 Gyp 22.2	Neog 20.5	Aq. 19.9	sp.? - 19.5 Hal - 19.4	Neog 19.2-18.7	Ger. 17.7	Neog 17.5	Neph. 14.3
Humerus	Gyp 241.9	Hal. 226.4	Neog. 217.6-214.5	Oto. 212.4	Neog. 208.2-202.8	Aq. 201.4?	sp.? 199.8	Ger. 159.9 Neph. 145.7
Ulna	sp.? 280.2	Gyp. 275.0	Oto. 274.9	Hal. 264.1	Neog. 251.7-236.0	Aq. 223.0	Ger. 189.2	Neph. 171.6
Carpus	Gyp. 122.84	Hal. 119.7	Neog. 111.5-110.6	Oto. 107.6	sp.? 106.3	Neo. 105-101 Aq 103	Neog. 98.4 Ger. 82.6	Neph. 77.5-8
Femur	Aq. 131.9	Hal. 126.1	Gyp. 125.0-.5	Neog. 113.4	Ger. 111.9?	Oto. 12.4-8	sp.? 104.3 Neog. 106.9-~~108.4~~	Neph. 70.8
Tibia	Gyp. 170.9	Hal. 166.0	Aq. 163.4	sp.? 159.4	Oto. 158.9	Ger. 153.4 Neog. 153.6	Neog. 148.9-140.9	Neph. 116.9
Tarsus	Ger. 114.7-	sp.? 108.4	Aq. 99.9	Gyp 99.5	Hal. 97.6	Oto. 95.5	Neog. 93.0-84.0	Neph. 81.3

Cran. breadth	Gyp. and Hal. — (to Aq.)
depth	Hal^{2} and Ger
Beak length	Neph. and Aq.^{1} (not close to either)
Depth	Hal^{3} and Oto^{4}
Sternum	Aq.^{2} and Hal^{4}
Coracoid	Aq.^{3} and Ger (not close to either)
Scapula	all — except Nephron
Humerus	Oto and Aq.^{4}
Ulna	Hal and Aq.^{5} (not near either)
Carpus	Oto, sp.? and Aq.^{4}
Femur	Oto^{4}, (~~Ger~~) sp.?
Tibia	Ger and smaller
Tarsus	Oto ? & Neph.

Haliaeetus - smaller
Aquila - larger except for feet?
Geranoaetus - larger
Gypaëtus - smaller
Nephron~~[illegible]~~ - larger
sp.? - smaller (near)
Otogyps - smaller-(near)

Neogyps was a bird ~~[illegible]~~ smaller than the Bald eagle and tho of unlike proportions to the Golden Eagle is nearer it in size, having, however slightly longer wings and shorter legs:

Aquila Body about as in Aquila, but with longer wings and shorter legs

Hal. Body slightly smaller than Hal, wings shorter, legs shorter

Oto Body smaller, wings about the same, tho shorter (shorter ulna), legs shorter (nearer than other sps. however) (little shorter)

Sp.? Body smaller, wings about same length but of dif proportions (longer hum. & shorter ulna), legs shorter (femur about same, however)

Ger. - Larger except legs, These are ~~longer~~ but shorter

Furcula

~~aquila~~

~~#3 22.7 609 = 37.2%~~
~~#5 24.6 64.3 = 38.2%~~
~~#4 24.4 71.3 = 34.2~~

~~q. mel 17.4 - 60.2 = 28.7%~~
~~frag. C 8184 15.5 - 55.0 = 28.9%~~
~~quin D 2508 17.2 59.6 28.8%~~

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length across a height at c

frag C 8184 55.0 - 16.9 = 30.7%
C 7346. 57.0 - 15.8 = 27.7%
C 9327 53.8 - 15.2 = 28.2

gen of Buteo or near

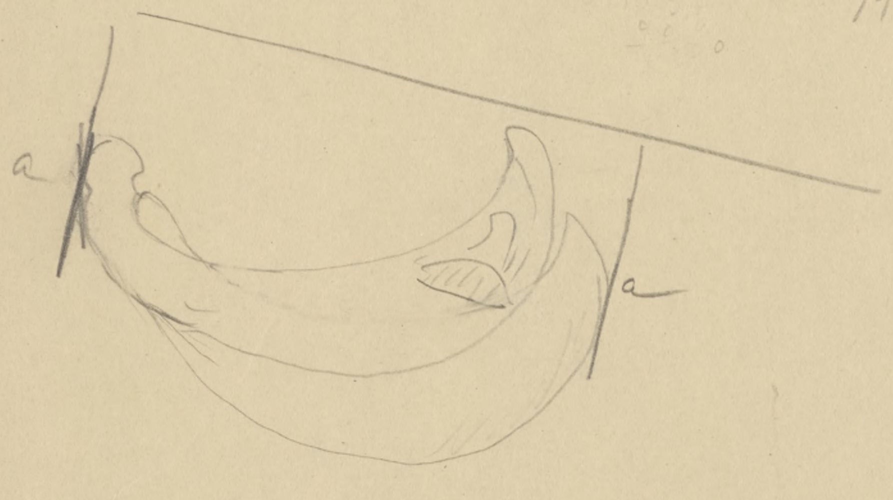
aq. 923 63.2 15.0 = 23.7
aq. 3 61.4 14.0 = 22.2
64.6 16.8 = 26.0
5
4 71.3 17.5 = 24.5
3 75.3 18.0 = 23.9

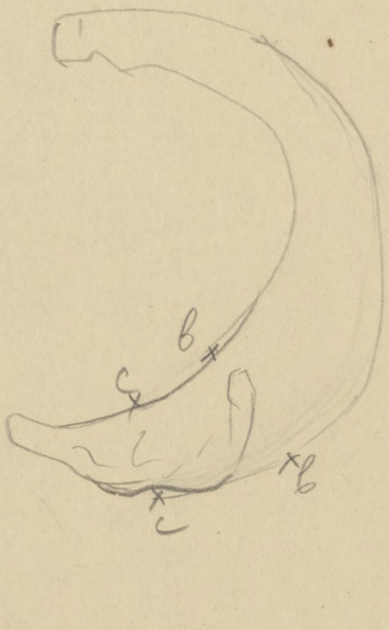
archibuteo 14 53.3 14.2 = 26.6
324 44.6 11.8 = 26.4

quin. J 6466 59.6 - 14.1 = 23.6%
C 5848 58.3 - 14.5 = 24.8%
aq. F 1917 58.5 - 13.9 = 23.8%
D 2508 59.6 - 13.6 = 22.8%

M. wood. D 3056. 80.3 ? 22.9 = 28.5%
q. mel 233 60.2 16.0 = 26.5%
Buteo 240 45.1 12.0 = 26.6
152 39.9 10.0 = 25.0
331 39.3 10.3 = 26.2%

79.2

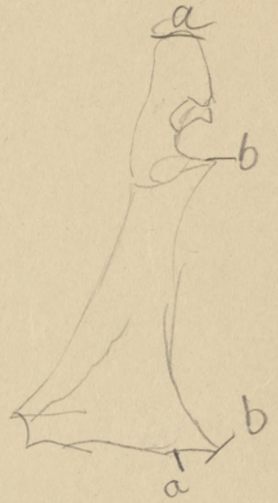




		a	c	. ca furcula continued
gen	C 5848	58.3.	11.1	= 19.0 % 7.3 –
	J 4466	59.6	11.5	= 19.3 %
	D 2508	59.6	10.3	= 17.2 %
	F 1917	58.5	10.0	= 17.0 %
pag	C 8184	55.0	12.7a	= 22.9
	C 9327	53.8	12.7	= 23.6
	C 7346	57.0	13.2	= 23.1
Aq.	923	63.2	11.9	= 18.8
	4	71.3	13.0	= 18.2
	5	64.6	13.4	= 20.7
	3	75.3	13.5	= 17.8
S. mel	233	60.2	14.0	= 23.2
Buteo	240	45.1	9.8	= 21.0
	([illegible]) 14	53.3	10.8	= 20.2
	331	39.3	8.8	= 22.3
	152	39.9	8.3	= 20.8
M. wood	D 3056	80.3	20.5	25.5 –
urubit.	738	42.1	8.8	20.9

	a	b	ba	
~~C9306~~	~~60.4~~	~~38.5~~	~~63.7~~	grinnelli
F600	60.3	39.9	66.0	B. gr.
C99,5	59.3	39.0	65.8	
C5842	61.7	39.3	63.6	X
D8107	62.2	41.2	66.9	
D4676	71.2	44.8	62.9	woodwardi
D2406	65.0	42.6	61.7	Aquila
C7476	69.1	43.2	62.5	
D2423	67.9	42.9	63.1	
C7557	59.0	36.7	62.2	fragilis
E1930	55.9	34.4	61.5	Aquila
E4148	57.8	36.0	62.2	
E1576	55.4	34.6	62.2	
D1167	54.0	33.3	61.6	
D1217	57.1	37.8	66.2	daggetti? - B. swain.
468 left	42.8	28.9	67.5	Buteo
238 left	44.9	29.7	66.1	uru
238 rt	44.7	29.5	65.9	
14	50.7	34.7	68.4	Buteo
307	44.4	29.6	66.6	
240 left	46.2	31.5	68.1	
240 rt	45.7	30.9	67.6	
152	41.6	28.4	68.2	
468 rt	43.1	29.1	67.5	
233 rt	60.7	38.8	63.9	g. melan
233 left	61.6	39.9	64.7	
471 left	71.4	44.9	62.8	Aquila
679 left	64.6	40.1	62.0	
471 rt	71.7	44.2	61.6	
679 rt	63.8	39.1	61.2	
4 rt	70.9	45.2	63.7	
927 left	69.9	42.4	60.6	
5 left	68.7	42.3	61.5	
926 rt	69.8	40.8	62.0	

coracoid



grinnelli

	a	c	~~ba~~
C5548	55.7	34.5	65.5
144412	52.1	34.0	65.2
C5714	60.5	39.6	65.4
B9856	60.1	38.7	64.3
D1817	60.6	39.5	65.1
C99,5	59.5	39.1	65.7
D,9	60.8	38.8	63.8
C1713	61.6	40.4	65.9

Femur

① Proximal end: *fragilis* & *woodwardi* - trochanter raised into crest over iliac facet; *grinnelli* not.

② Orifice on anterior side near trochanteric ridge - tendency to have two - fragilis & woodwardi; only one in *grinnelli*.

③

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fragilis-woodwardi

①- Geranoaëtus - Buteo

②- " "

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grinnelli

① Aquila

② Aquila

Carpo-metacarpus

① Size of intermetacarpal space; woodwardi - narrow; fragilis narrow; grinnelli broader

② Shape of distal metacarpal symphysis; woodwardi flat and angular; fragilis - flat and rounded; grinnelli - excavated and rounded.

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fragilis

① Buteo
② Buteo

---

woodwardi

① Geranoaëtus
② Geranoaëtus

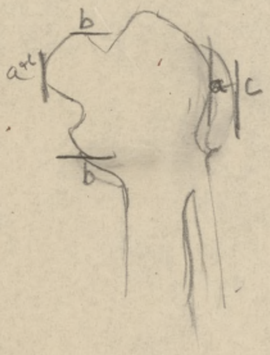
---

grinnelli

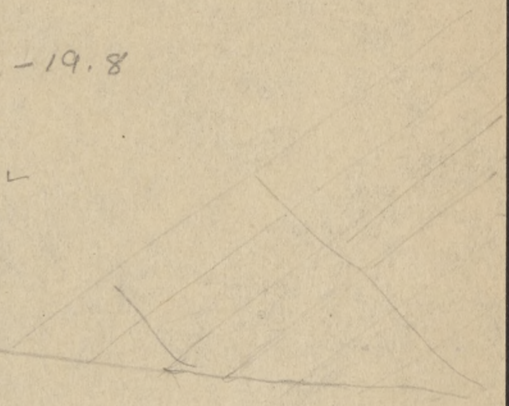
① ?
② Aquila

	a	b	c	ba	bc	
	19.1	12.8	21.7	67.0	58.9	
C5815	18.2	11.7	21.0	62.1	55.7	fragilis
E9744	24.9	16.6	28.4	66.6	58.4	woodwardi
D2236	21.3	14.1	24.1	66.1	58.5	
C603	18.5	10.5	20.8	56.7	55.7	fragilis
679	21.1	13.8	24.9	65.3	55.4	aquila
421	23.0	15.3	27.0	66.5	56.6	
233	20.2	12.3	23.1	60.8	53.2	Geran
307	13.5	9.3	15.3	68.9	60.7	Buteo
138	13.2	8.8	15.3	64.2	55.7	Uru
C832	18.9	13.2	21.2	69.8	62.2	grinnelli
H 2622	18.9	13.3	21.1	70.3	63.0	
H 2221	19.7	13.2	22.2	67.0	59.4	
C5187	26.0	17.3	29.4	66.5	58.8	length 128.4
D1702	22.9	14.3	26.3	62.4	54.3	woodwardi 116.2
E4997	24.5	14.9	27.8	60.8	53.5	
D2238	21.3	14.4	24.6			104.4

Carpus



Tarsus	Length	Rel. br. prox.	dist ends	
Wetmoregyps	167	11.8%	13.6%	1
M. woodwardi	1 140 - 125 1	17.0	20.0	3
U. fragilis	3 113 - 96 3	16.0	18.0	2
S. grinnelli	100. - 107 2 114 - 101 2.	16.4 18.0	18.5 20.5	17.4 - 19.8 4
Neogyps	5 93 - 84 5	22.	25.	5 ✓
Neophrontops	4 97 - 85 4	15.7	16.6	



Tibia				
Wetmoregyps	215		9.8%	1
M. woodwardi	1 190 - 171 1	12.5	12.7	4
U. fragilis	4 149 - 130 4	12.1	12.2	2
S. grinnelli	2 164 - 150 2	12.4	12.0	3
Neogyps	3 153 - 140 3	13.9	13.4	5 ✓
Neophrontops	5 124 - 109 5	12.2	11.9	

29/8

Femur				
M. woodwardi	1 130 - 124 1	20.0	16.0	2
U. fragilis	4 107 - 95 4	19.0	15.0	1
S. grinnelli	2 121 - 112 2	21.4	16.8	3
Neogyps	3 113 - 103 3	22.0	17.0	4 ✓
Neophrontops	5 83 - 71 5	23.9	17.6	

16.9°

61
38
94

24
18
17
59

72